VOL. XVIII. No. 10

OCTOBER 1933

MECCANO MAGAZINE

SKY RIDE AT CHICAGO WORLD'S FAIR (see page 738)

6D.

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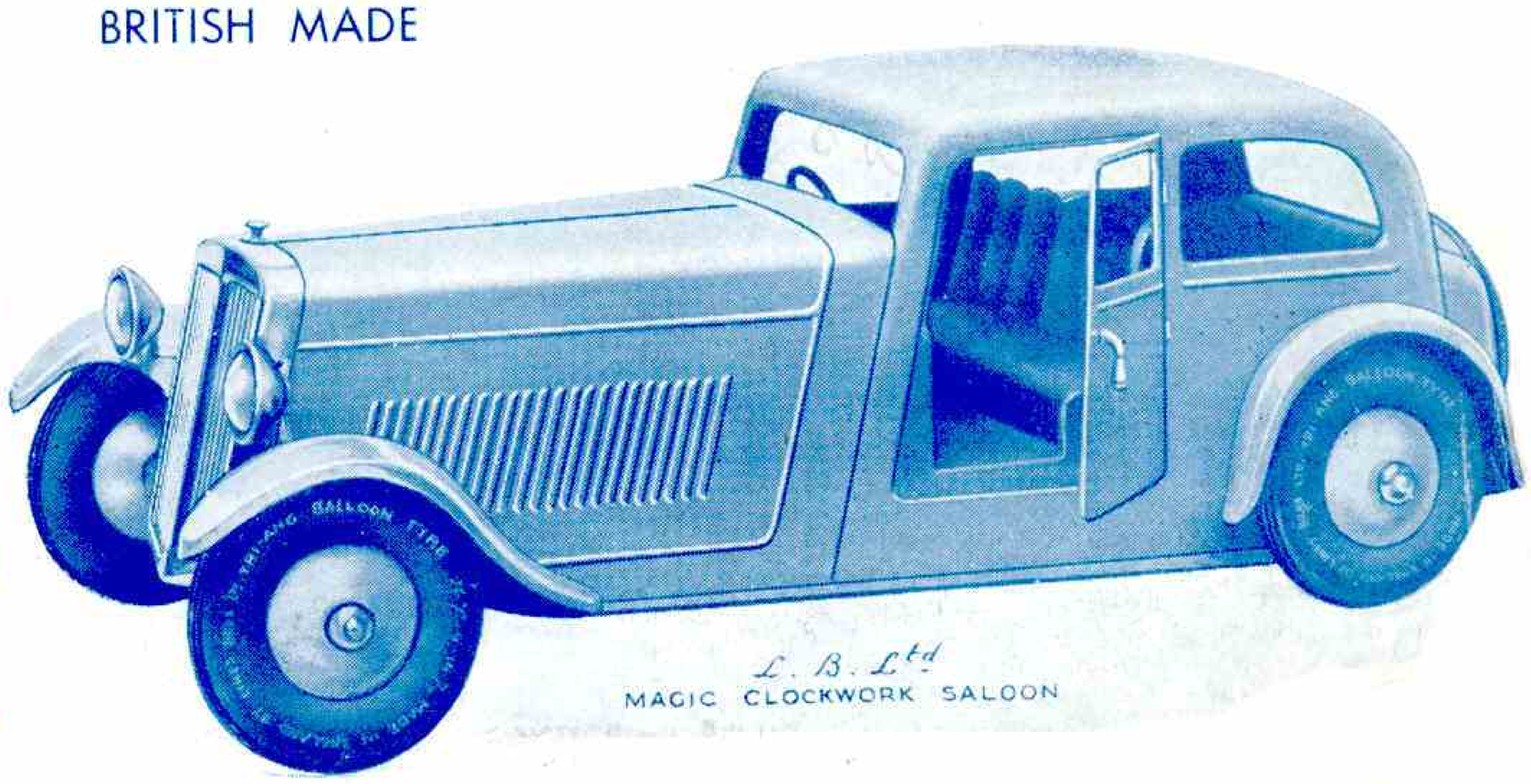
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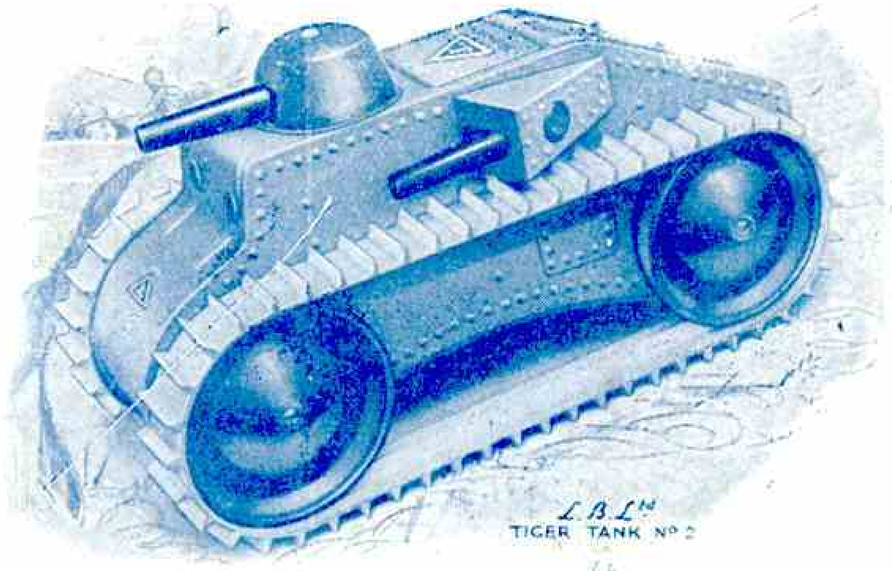
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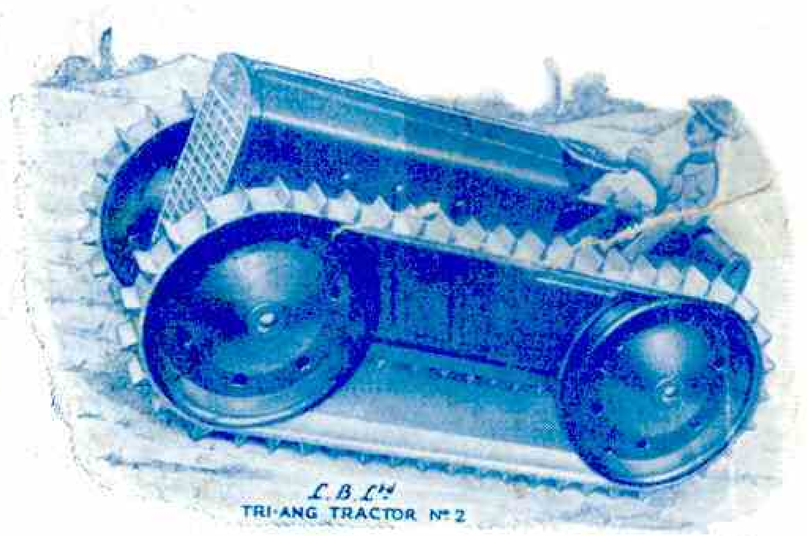
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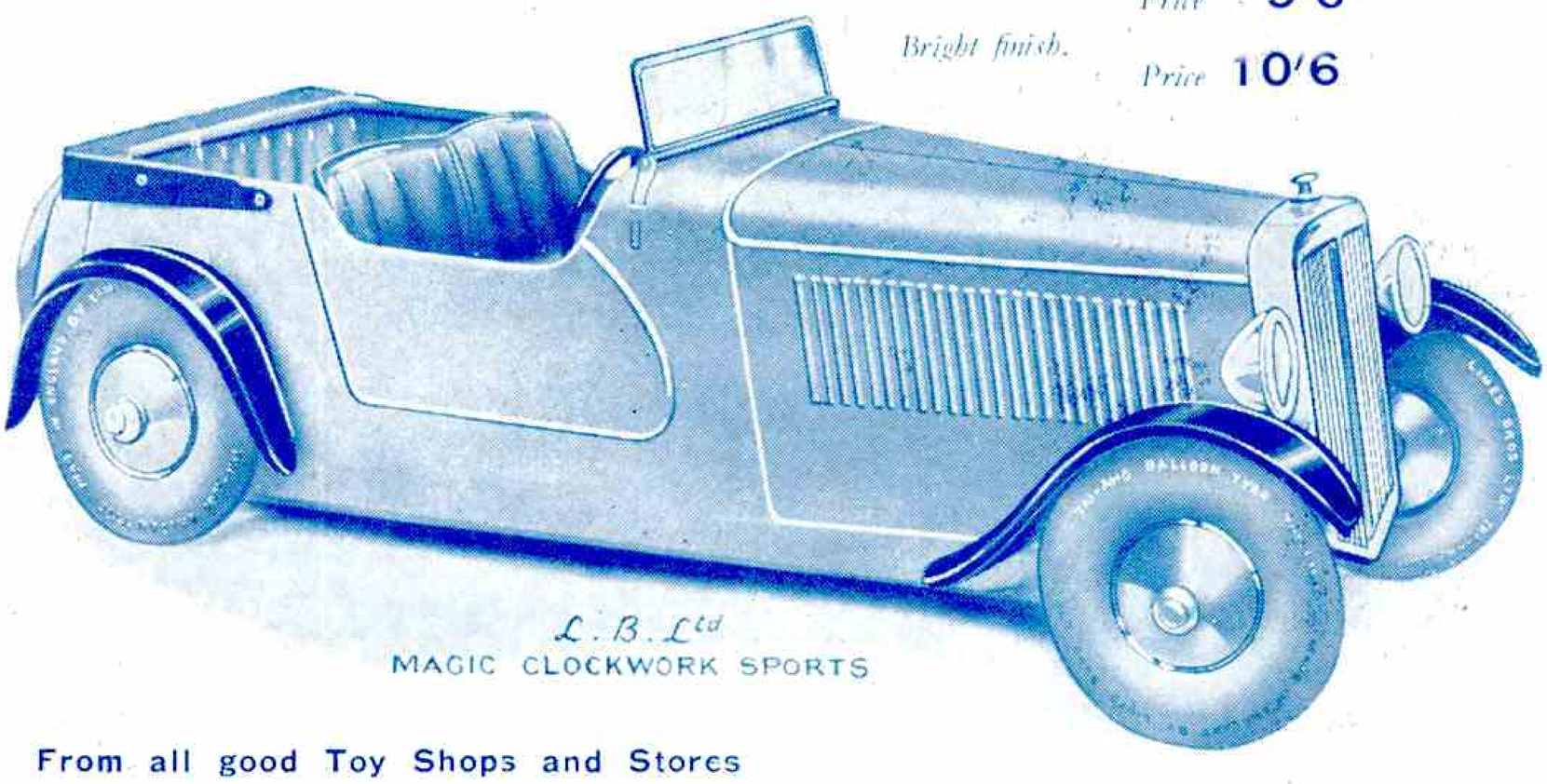
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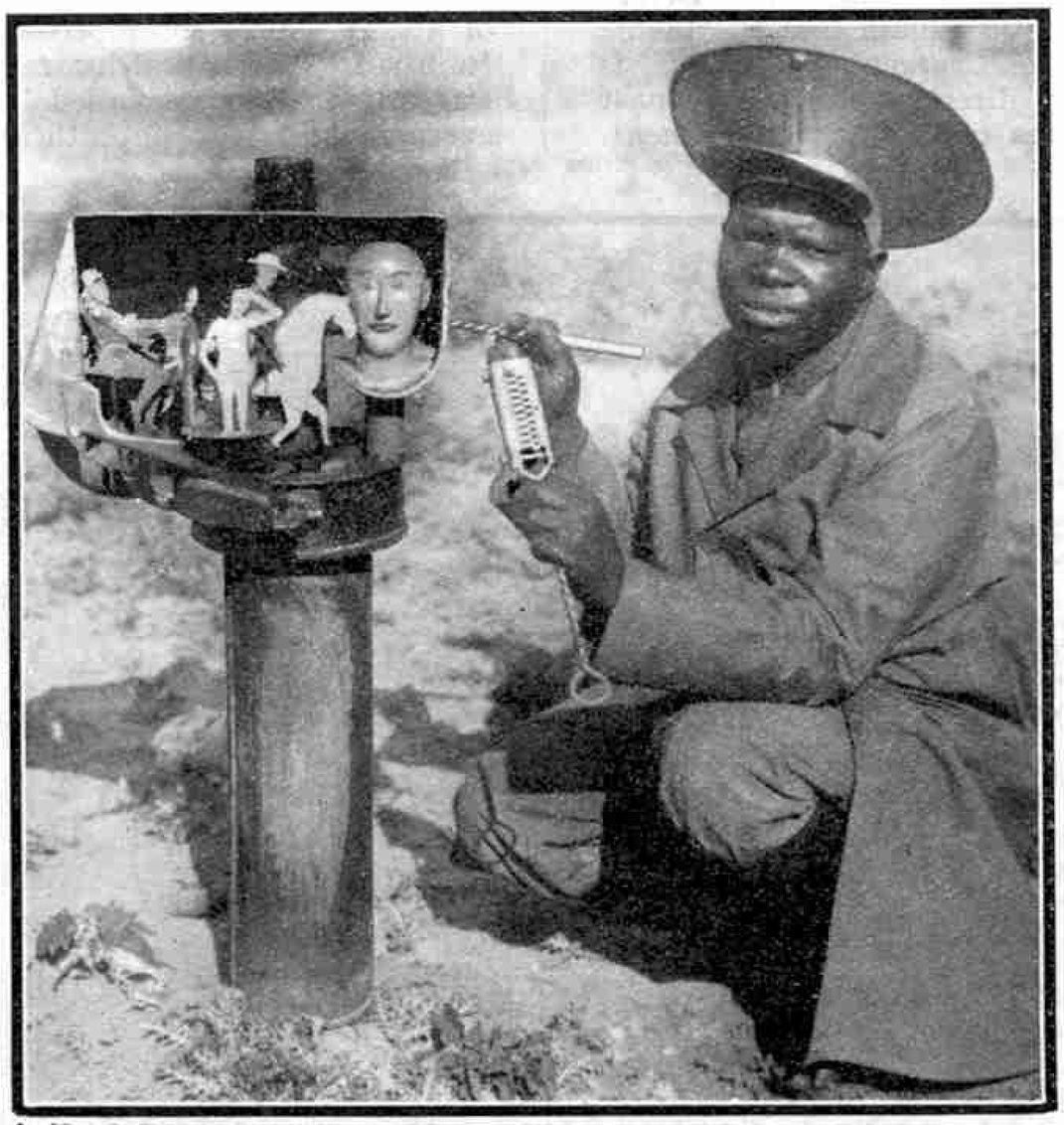
With the Editor

The Fascination of Accuracy

The early inventors had many troubles that do not worry their successors of to-day, and among these was the difficulty of finding workmen capable of carrying out their ideas with sufficient accuracy. James Watt, for instance, was baffled for a long period by what he describes in one of his letters as "villainous bad workmanship." In spite of his continual grumbling Watt did little to improve matters in this respect, and the credit for taking the first real steps towards mechanical accuracy probably should go to Joseph Bramah. After he had invented the lock that bears his name, Bramah was greatly troubled by the impossibility of getting its parts produced by hand in sufficient quantities and at the same time of uniform accuracy. He therefore set to work, along with Henry Maudslay, who at that time was his foreman, to devise machine tools to carry out the necessary operations.

Maudslay was a craftsman of the finest type, for whom extreme accuracy had an intense fascination. He regarded perfect workmanship as a duty, and Nasmyth, the inventor of the steam hammer, said of him that his character could be seen in every piece of work he produced. He turned the crude lathe of his day into a first-class machine tool by the addition of the slide rest, and he was the first to tackle the problem of systematic screw cutting. Up to that time there had been no system of proportioning the number of threads of screws to their diameter, the result being that each nut and bolt formed a distinct partnership, and were not interchangeable with neighbouring nuts and bolts. The danger of confusion when a machine was taken to pieces for repairs was so serious that it was the practice to mark carefully each bolt and its corresponding nut! Maudslay altered all this, and in his system of screw-cutting machinery, and in his taps and dies, he laid the foundation of all that has since been done in this branch of machine construction.

Maudslay's pioneer work was carried on and extended by Joseph Whitworth, whose career is described in this issue. The screw thread developed by Whitworth, which is now practically universal in this country, has been of enormous importance in the growth of engineering during the past century. Accuracy, indeed, was the ruling passion in Whitworth's life, and it urged him on to one improvement after another, all contributing towards the development of the vast army of machines that supply the needs of the world to-day. It is interesting to note that the schemes of regular flag stones and chalk marks dividing up the floors of his machine shops seem to show that Whitworth had visions of modern method of mass production.



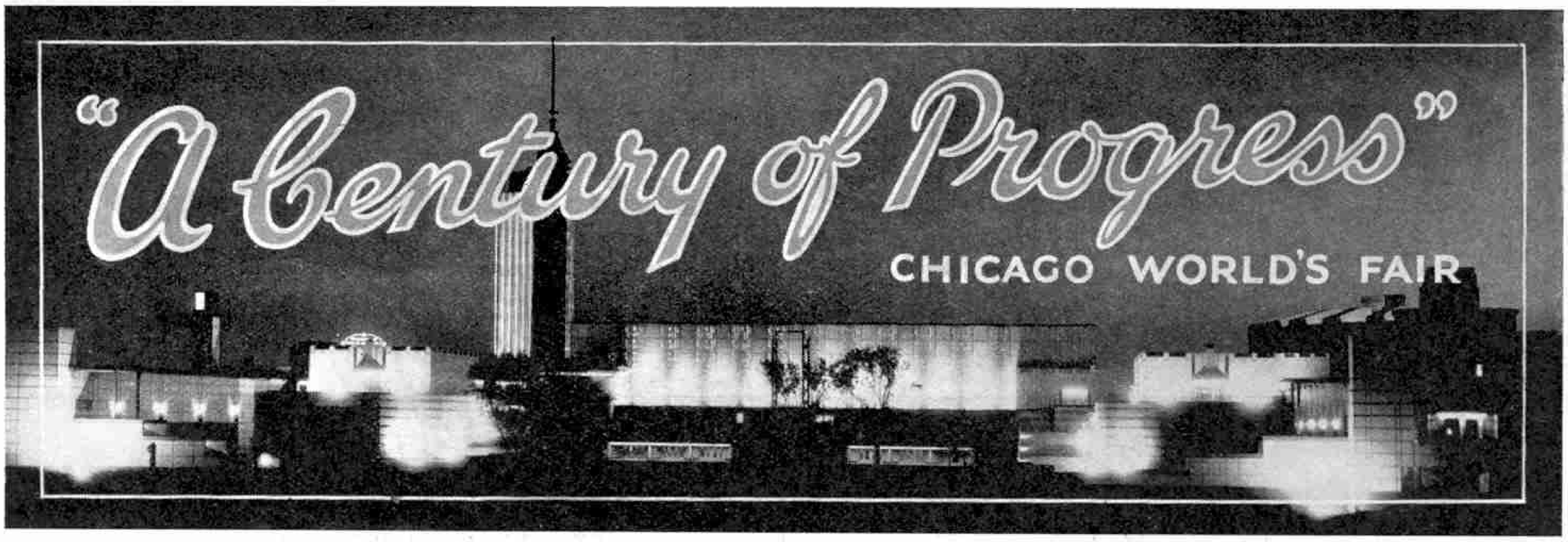
A Natal Zulu with a steam-driven miniature roundabout he has constructed from scrap metal. The mouth organ in the native's left hand is blown by a jet of steam.

The National "Grid" Scheme

The past month has seen the completion of the national "grid" scheme of the Central Electricity Board, the greatest scheme of its kind in the world.

The first Electric Lighting Act, granting powers to lay cables underground or overhead, was passed in 1882. The success of the scheme concerned resulted in the passage of other Acts granting powers to electricity companies, and the use of electricity steadily extended. During the present century the demand for electricity in this country has increased to an enormous extent, and has resulted in the erection of a large number of power stations of various sizes to serve local areas. These stations came into existence independently, and differed considerably in the type of current they generated. It became evident that so long as these differences existed it would be impossible to develop electrical power on a national scale, and at a cheap rate, and in 1926 there was passed the Electricity (Supply) Act, under which the electricity supply of the country was to be completely reorganised. The plans prepared by the Central Electricity Board provided for the division of the country into districts served by a network of overhead cables, known as the "grid," by which electrical power generated at a certain number of large generating stations of the highest efficiency was to be transmitted at a pressure of 132,000 volts. This power was to be sold by the Commissioners to electric supply companies, which would deliver it to consumers at certain standard voltages. The smaller and less efficient power stations were to be closed down, and to be replaced as necessary by stations specially built to specified requirements. The "grid" is now finished, and it is expected that the complete system will be in operation before the end of next year. Ultimately the scheme will bring cheap electrical power to every part of the country.

The "grid," which has taken 5½ years to complete and has cost £27,000,000, has provided employment directly or indirectly for some 200,000 people. The towers that carry the overhead transmission lines number 26,265, and are mostly from 70 to 80 ft. in height. For carrying lines across rivers, towers of greater height have had to be used. The towers that link up the "grid" south of the Thames with Dagenham are 487 ft. high and weigh 290 tons, and these remarkable structures will be described in a forthcoming article. There are altogether 4,000 miles of transmission lines, 2,894 miles of which operate at 132,000 volts, and the remainder at 33,000 and 66,000 volts respectively. Enormous quantities of materials have been used in the constructional work, including 170,000 tons of high-quality steel and 12,000 tons of aluminium.



By EDWARD T. MYERS

IN the "*M.M.*" of March last I described the elaborate preparations then being made for the second Chicago World's Fair, and dealt with the chief constructional features of the various palatial exhibition buildings. In this article I shall describe some of the fine exhibits that I saw during a recent visit. Before doing so, however, I should like to mention again that the theme of the Fair, which has for its name "*A Century of Progress*," is the advancement of mankind in every direction during the past 100 years. It is a wonderful panorama of human achievement.

Travelling on an Illinois Central Electric suburban train from South Chicago, I soon found myself approaching the Fair grounds from the south, and as the train drew near I sighted the beautiful green and blue Travel and Transport Building. All the entrances to the Fair adjoin suburban stations, and after leaving the train I crossed over the bridge from the station and a few minutes later I was in the grounds. Almost the first thing I caught sight of was "*The Royal Scot*," standing in the special sidings just south of the Travel and Transport Building, and being a keen railway enthusiast I immediately headed for that part of the Fair. "*The Royal Scot*" appeared exactly like the coloured illustration on the cover of the "*Hornby Book of Trains*," except that the front of it had been equipped with a powerful searchlight at the top of the smoke-box door, and a large brass bell between the headlamps. I was impressed by the extremely fine workmanship of the train.

For companions at the Fair "*The Royal Scot*" has on one side a modern Burlington train of six coaches, and on the other side the "*Capitol Limited*" express of the Baltimore & Ohio Railroad. After completing my tour of inspection of "*The Royal Scot*" I went through the "*Capitol Limited*," the coaches of which are painted dark green and are air cooled throughout. The huge locomotive, No. 3000, of the Burlington train interested me greatly, as it is the most powerful 4–6–0 locomotive in the world. Opposite to this train I saw one of America's historic locomotives, No. 35, "*The Pride of the Prairies*," which dates from the early eighties. Another interesting exhibit is a reproduction of the first railway coach in which U.S. mail was sorted during transit, this notable event taking place in 1862. The coach is a very crude affair with a wood-burning stove, and there is an iron rail for the mail clerks to hang on to when the coach was off the track.

In the Travel and Transport Building I saw a full-size chart of a "H" class locomotive of the Chicago and North-Western Railroad. The actual locomotive, under steam, takes part in the Pageant of Progress called "*Wings of a Century*," that is given every night in an amphitheatre on the shore of Lake Michigan. Other interesting locomotives I saw were the New York Central "999" that was shown at the first Chicago World's Fair, in 1893; the Delaware and Hudson Railway's "*Stourbridge Lion*," the first locomotive to run on an American railway; and the same company's new high-pressure locomotive, "*L.F. Loree*." Many fine exhibits were grouped under the great dome of the building, including a new type all-metal Wasp-engined Boeing transport aeroplane; a U.S. Government railway coach for the transportation of compressed helium, the first Pullman coach, which ran on the Chicago and Alton Railway, and two modern aluminium, air-cooled Pullman coaches.



A fine aerial view of "A Century of Progress," the Chicago World's Fair. In the left foreground is the Travel and Transportation Building, and in the centre the Sky Ride spanning the lagoon. The upper photograph is of the Hall of Science, brilliantly illuminated at night. The illustrations to this article, with the exception of the upper one on the opposite page, are reproduced by courtesy of "A Century of Progress," Division of Publications, Chicago.

The main hall of the Travel and Transport Building is filled with interesting displays and motion picture shows. Four "dioramas," scenic pictures that give a sense of three dimensions, show the work of the railways by day and night. They represent respectively a spring scene in an agricultural district; a summer scene intended to appeal to holiday-makers; an autumn scene showing a night in a large city, and a winter scene in a lumber camp. A four-track road runs along these scenes, and on it freight trains, passenger trains and petrol electric cars run continually. When one tires of walking round and inspecting these numerous displays, one may rest in any of the comfortable free theatres provided there by the railway companies, and while resting enjoy a travel tour to any part of the world by means of talking pictures, some of which are in colours.

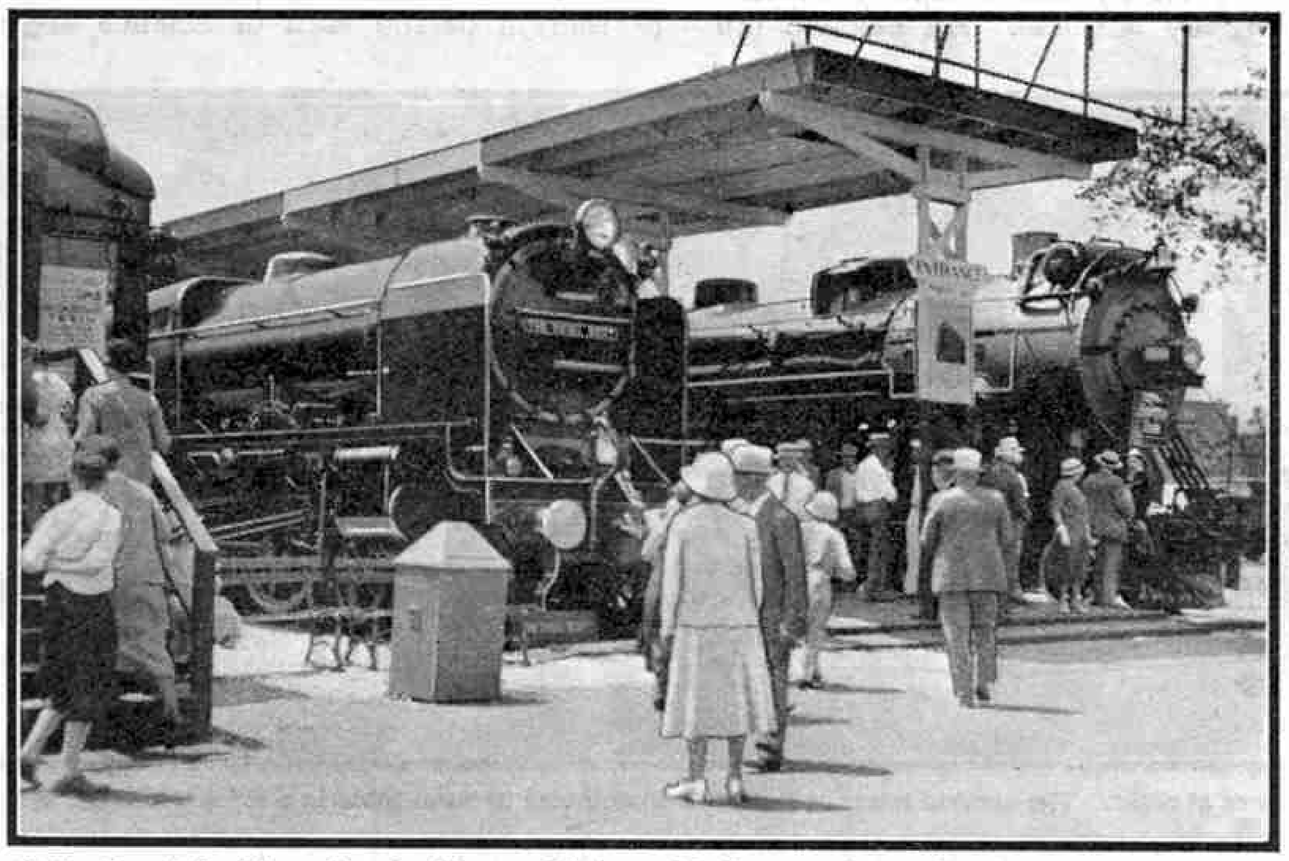
I next turned my attention to the motor car displays, and visited the General Motors Building, which is one-eighth of a mile

long and is surmounted by an orange-coloured tower 177 ft. high that is brilliantly illuminated at night. The chief feature of this great building is a complete assembly line, and from a balcony 1,000 people can witness every stage in the assembly of Chevrolet motor cars, beginning with the introduction of the raw materials and concluding with the finished car. The Chrysler Building, north of the Travel and Transport Building, is in two sections, and includes a ¼-mile exhibition track inclined steeply at one side. In another large building I saw motor car tyres being manufactured at the rate of one every 10 minutes. Mention must be made also of the Cord Corporation's exhibit, a £4,000 "Dusenberg," that is said to be the most costly motor car in the world. The car has an all aluminium body and cast aluminium doors, and its instruments include a compass and an altimeter. It is driven by a 320 h.p. motor and can attain a speed of 135 m.p.h.

By this time I was rather tired of walking, so I had a ride in one of the six-wheeled semi-trailer buses that convey visitors about the Fair. An illustrated description of these unique buses was given in my previous article. I alighted from the bus at the Sky Ride, the long cableway that transports visitors across the lagoon from the mainland to Northerly Island. Each of the two steel towers of the Sky Ride is 628 ft. high and is topped by an observation platform, from where on a clear day four States are visible. The cableway along which the rocket cars travel is at a height of 219 ft. An upward view of one of these towers, taken from just below the cableway, is shown on the cover of this issue. There are four lifts in each tower, two travelling only up to the rocket car platform, and the other two up to the observation platform. The two short-distance lifts rise at the rate of 500 ft. per min. and the other two at the rate of 700 ft. per min.; but in every case discomfort to passengers is prevented by slow deceleration.

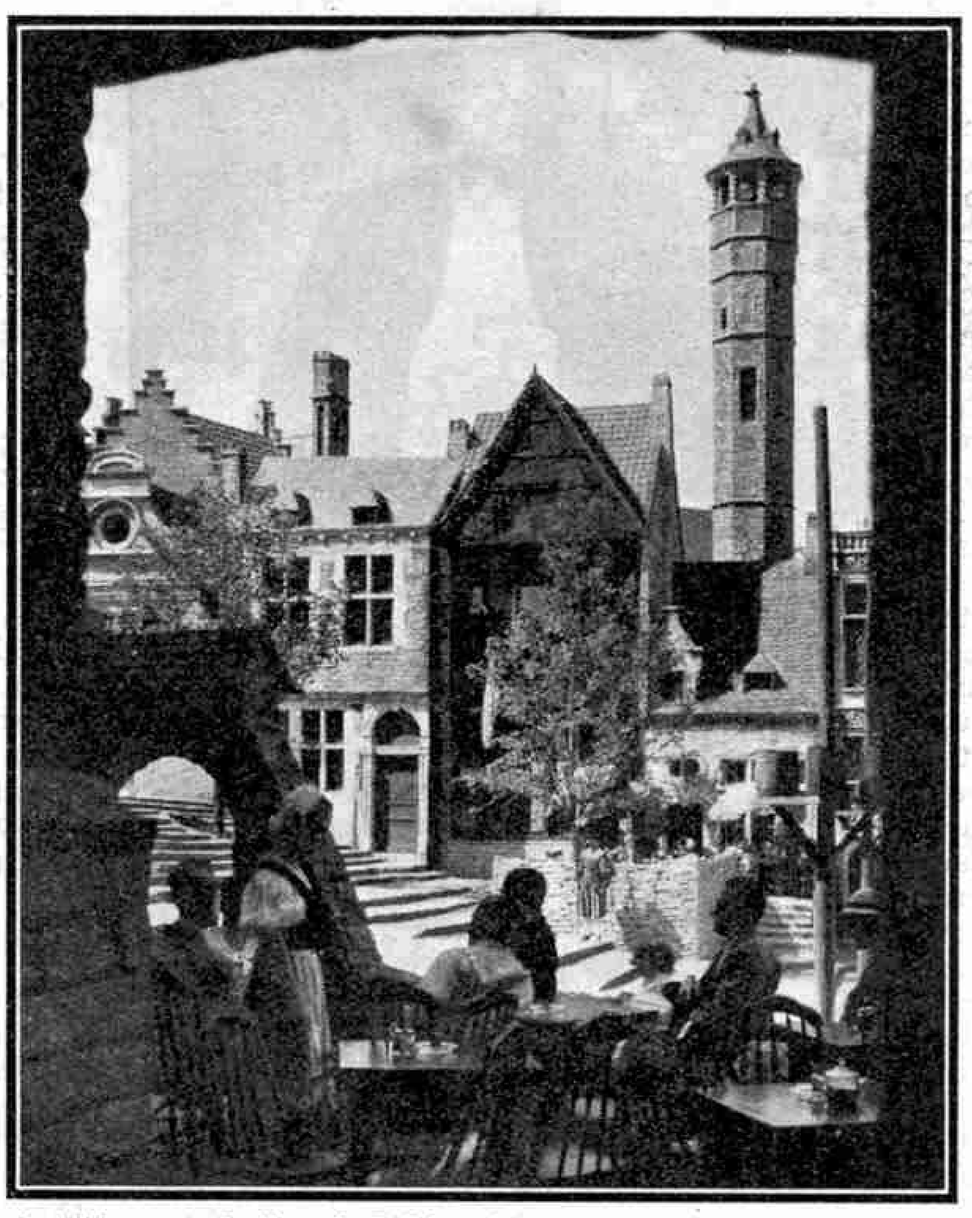
I travelled up to the Sky Ride platform and there entered a car shaped like a rocket. The rocket cars are double-deckers and can seat 36 passengers, who are accommodated in a row of seats by the windows on each side. When watched from the ground the cars appear to travel very smoothly and slowly, but I soon discovered that the going is very rough. The guard shouted "All aboard," shut the doors, and the car started with a grating sound. It operated under its own power until it reached the end of the short iron track that extends past the platform, and then moved out on to the cableway and was hauled across to the other tower by traction cables. In order to minimise the sagging of the cables forming the runway, these are supported at about 10 points by iron brackets held in place by overhead ropes secured to a high cable.

The car ran fairly smoothly until it reached the first supporting bracket, when the front of the vehicle heaved up in the air. Before I realised what had happened the car levelled and was nosing downward on the next "sag," accompanied by a terrible grating noise overhead. As the car neared the next support I clutched the seat immediately in front of me with all my might, and by the time three of these brackets, where the sagging is suddenly taken up, had been safely negotiated, I had recovered sufficiently to look through the window and admire the fine view of the Fair below, the beautiful Lake Michigan and, westward of it, the city of Chicago. Eventually the car reached the other tower, having traversed a cableway 1,850 ft. long, the second longest suspended span in the world.



"The Royal Scot," equipped with searchlight and bell to conform with American practice, on view at the Fair. Photograph by Edward T. Myers.

Descending the island tower of the Sky Ride, I made my way to the Electrical Group, consisting of the Electrical, Wireless and Communications buildings. The Electrical Building is a fine structure with two tall orange-coloured towers facing the lagoon. The first thing that caught my eye on entering was the "House of Magic" of the General Electric Company of New York, and I immediately joined the long queue of people waiting for admission. When at last I was inside I witnessed a wonderful lecture and demonstration of the application of vacuum tubes. A young man demonstrated the use of a thyratron tube to control theatre lights, enabling them to be dimmed gradually in order to avoid shock to the eyes of the audience. The demonstrator then said that he was going to be "a bit old fashioned" about turning on the lights, and he lit a candle. To the astonishment of the audience the result was the switching on of the electric lights. The explanation was that the candle was in front of a photo-electric cell, and as its light fell upon the negative electrode, a stream of electrons was shot out to the second electrode, which attracted them because it was positively charged, and this completed an electric circuit that in turn operated the main lighting switch.



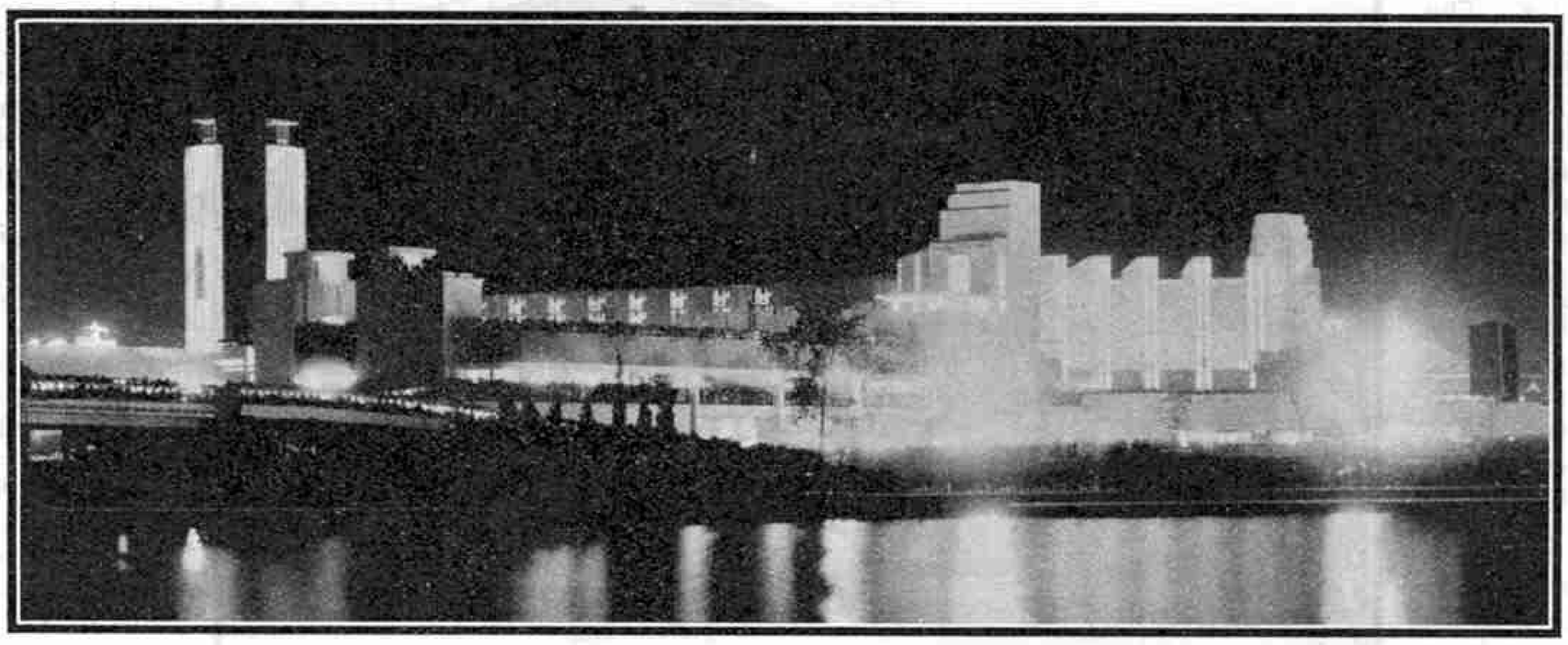
A striking reproduction of a Belgian village, complete with cobbled streets, ancient market, and girls in Flemish costumes.

After this demonstration he started an electric gramophone pick-up playing a record having only one tone. The weak current from the pick-up was amplified and conveyed to a cathode-ray oscillograph that traced a neat wavy line on the green background of a screen. He then played an orchestral record and one made by a soloist, and in these instances the design on the screen was an extremely complicated pattern of waves of various sizes grouped together. In each case the oscillograph had reproduced the sound waves in such a manner that the vibrations became visible.

The current from the pick-up was then fed to a lamp, and the light from this focussed on a photo-electric cell across the stage. The ray of light was so weak that it was invisible to the audience, but the photo-electric cell picked it up and changed it into an electric current that, when amplified, operated a loud speaker. When the demonstrator put his hand in front of the beam, causing a shadow—an invisible one!—on the photo-electric cell, the music stopped. This proved that sound can be translated into electric current, the current into light, the light back into electricity, and the electricity once more transformed into sound.

The demonstrator next brought out a shawl that he said was very beautiful, but which to the audience was only an ordinary plain-coloured cloth with a fringe and decorated with two gaudy orange-coloured birds. He switched off all the visible lights, and immediately the shawl turned a beautiful purple, with the letters G.E. in a circle, two beautiful birds and a fringe having all the colours of the rainbow. The secret of this transformation was revealed when he showed that invisible ultra-violet light was directed on the shawl, causing certain materials in it to become fluorescent.

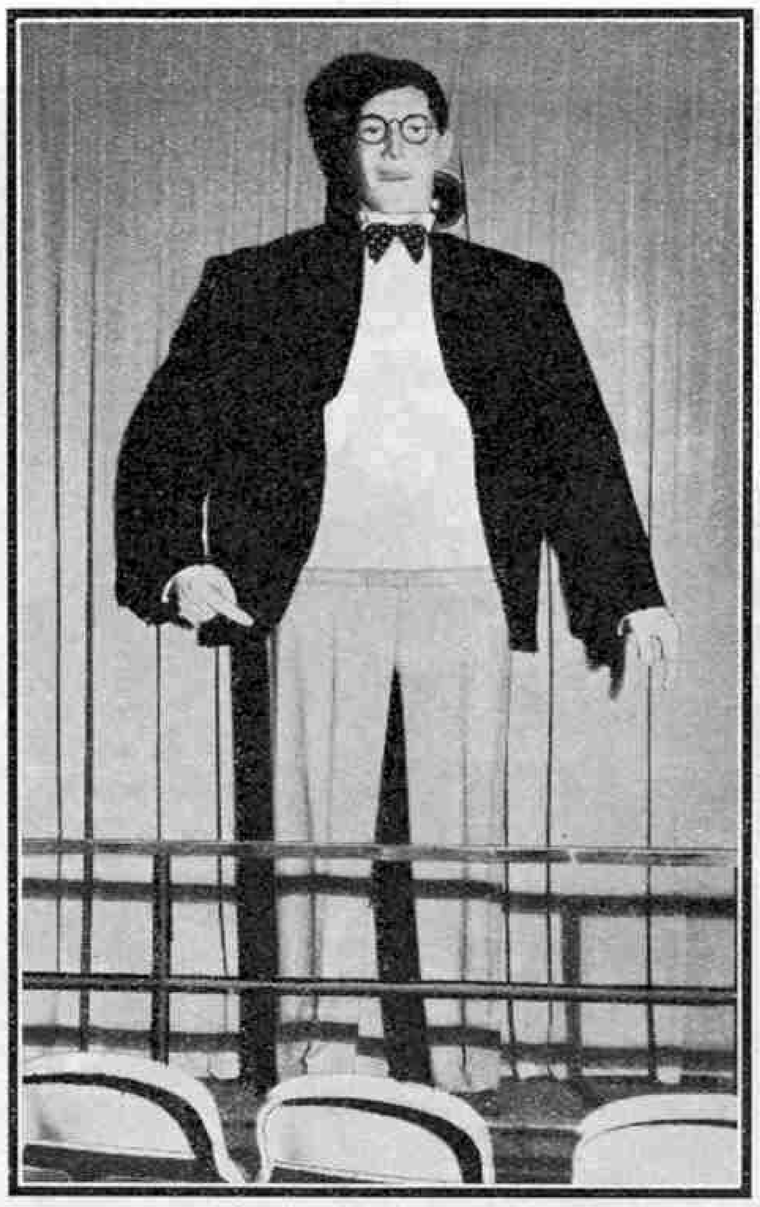
The display of the Westinghouse Electric Company is arranged along a balcony overlooking the Hall. A model of the American airship "*Macon*" flies about near the ceiling, and visitors can start or stop it by speaking into a microphone on the ground floor of the building. Another exhibit by this company demonstrates the transmission of power by wireless. An electric fan with its leads attached to two copper rods starts when a broadcasting set is turned on, for the rods serve as aerials to receive the radiated energy. A 60-watt electric light, the terminals of which are attached to two copper rods each 6 in. long, lights when two visitors take hold of the rods. An ultra-short wave broadcasting set sends music to either of two receiving sets, depending on the direction in which the reflector aerial is pointed, a few degrees of turn being sufficient to cut off the music.



The Hall of Science at night. The carillon tower at the left is illuminated by neon tubes in a mysterious blue and rose colour.

Public Service corporations have combined to give a single exhibit that by means of model power stations illustrates how water power is utilised to generate electricity. One section of the display shows a power plant at the foot of a mountain, availing itself of a swift mountain stream, and another section, showing a similar plant on a plain, illustrates how the greater volume but slower motion of a river is utilised to the same purpose. As night falls, model city buildings and homes light up, and shadowy streets become patches of bright light. There is also a working model of a turbo-generator with a large section open to reveal the rotor.

The acoustical exhibition of the Bell Telephone Company is one of the most interesting displays at the Fair. Visitors are seated on a balcony from which they look down on a glass-enclosed sound-proof stage where there are the demonstrator and a dummy—a well-dressed "man" with his back to the audience. Each visitor has a pair of earphones, and the demonstrator explains that the left earphone is connected to a microphone in the dummy's left ear, and that the right earphone is similarly connected to the dummy's right ear. As the man talks he walks about the stage, and the sound of his voice is received first through one earphone and then through the other. He suggests that the audience close their eyes in order to make the illusion seem more real. He poured some water, and my right ear heard the sound clearly, and when, from another part of the stage, he tore a piece of paper I heard the sound in my left ear. This and many other interesting demonstrations proved why two ears are so valuable to us, enabling us to tell the direction and from what distance a sound comes.



The remarkable 10 ft. talking robot in the Chemistry Section of the Hall of Science.

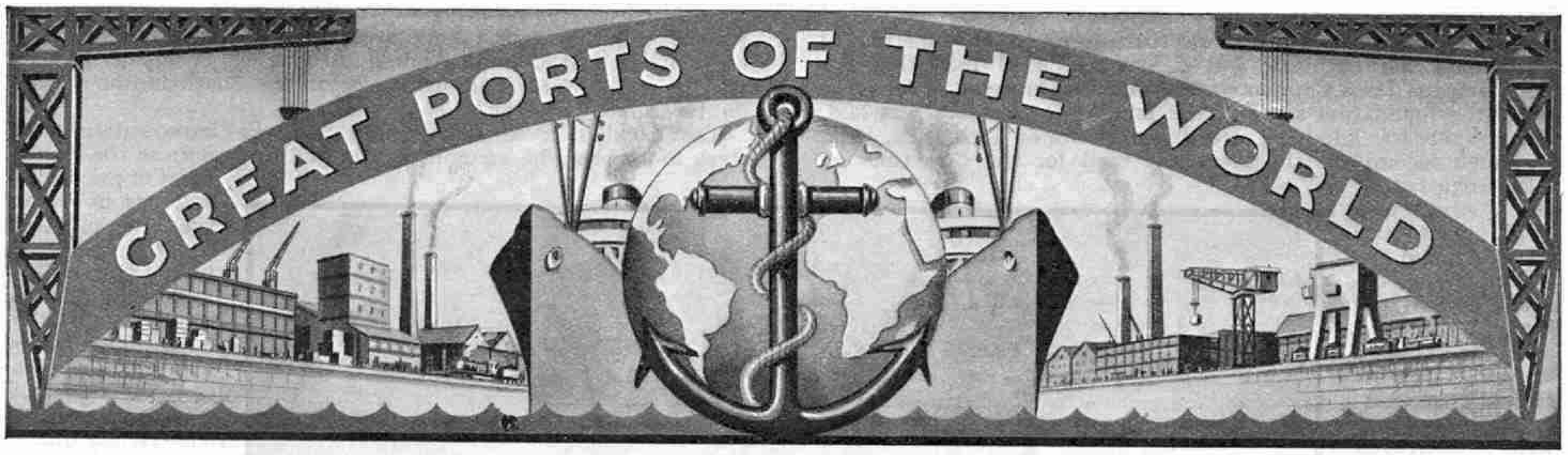
Leaving this interesting building, I returned to the mainland, and made my way to the Hall of Science which, I think, is the most beautiful building at the Fair. It is pure white, with blue panels on which white sculptural pieces are outlined. The building contains an exhibition area of nine acres, and one could spend two or three days in studying the numerous exhibits it contains. The geological exhibits include geysers; volcanoes in action; a "clock of the ages" that compresses two billion years into a two-minute revolution of its hands; and models of Niagara Falls, oil wells, underground rivers, and seismographs. Especially interesting are the heavy iron "Bathysphere" in which Dr. William Beebe descended 2,200 ft. into the ocean depths, and the actual aluminium car in which Dr. Auguste Piccard ascended 54,000 ft. into the stratosphere. In another section I saw a remarkable transparent model of a man that showed the position of the principal organs of the body.

The various demonstrations and displays in the chemistry section of the Hall of Science are most interesting. There one may see sulphuric acid made from sulphur; a ribbon of iron burn like paper when heated in a jet of oxygen; and potassium dropped into water displacing hydrogen that burns with a beautiful blue flame owing to the presence of this remarkable metal. A battery of electric furnaces shows the use of intense heat, and I discovered that I could safely put my hand inside an induction furnace in which a rod of iron would blaze and drip like melting wax, as although iron is an electric conductor, my hand is not.

A specially remarkable demonstration is the liquid air display. Liquid air is produced by compressing air to a pressure of 3,000 lb. per sq. in., and suddenly releasing it through a jet. The temperature falls rapidly to about 317 deg. F. below zero, and the air is condensed to a pale bluish liquid of about the consistency of water. The demonstrator dipped a stick into a mould full of mercury and placed this in liquid air, when the mercury instantly froze so hard that he was able to drive nails with it. Next he poured some liquid air into a kettle and set this on a block of ice, and immediately large clouds of white vapour poured out of the kettle. Many of the audience regarded this demonstration as marvellous, but it is explained by the fact that the ice, cool as it is by ordinary standards, is hot enough to bring the temperature of the liquid air to its boiling point, which is about 310 deg. F. below zero. The heat gained by the air was lost by the ice, and in a short time the kettle was frozen to the block.

The demonstrator next corked some liquid air in a vessel, but the pressure within rose so high that the cork was blown out and across the room, proving that it is necessary to keep liquid air in an open vessel so that the vapour can escape. He then poured some liquid air into a small glass and inserted a rubber ball. The rubber became so hard that when he tried to bounce the ball it broke into hundreds of pieces.

In another part of the Fair I saw the replica of Fort Dearborn, Chicago's earliest settlement. The brave inhabitants of the original fort were massacred by Indians in 1812. The flag flying from the pole in the parade ground of the replica bears the 15 stars and stripes of that year, and the guards are dressed in the red and blue army uniforms of the period. Close by the replica of Fort Dearborn is the Lincoln Group, which includes a fine reproduction of the cabin where Abraham Lincoln was born 123 years ago, and of the historic Chicago convention hall where, in 1860, he was nominated for the Presidency of the United States. I also visited the replica of the famous Golden Pavilion that was built in 1767 at Jehol, the summer home of the Manchu emperors. It is 60 ft. high, 70 ft. square, and is erected on a 4-ft. stone pedestal, and the double-decked roof of copper shingles is covered with a pure gold roof. Rare oriental treasures collected from other Lama shrines are on view inside the temple.



VI.—SOUTHAMPTON

THE great ports already dealt with in this series all owe their importance to the immense commerce carried on through them. Southampton, however, is famous as the chief passenger port of the kingdom, although freight traffic has been carried on there from very early times.

When excavations were being made at Southampton in connection with deep-water docks, and particularly the Empress Dock, evidence was obtained that what is now known as Southampton Water was once a valley providing a common outlet for the rivers Itchen and Test. Geological changes had caused a subsidence of the valley and as a result Southampton Water was formed practically as we know it to-day. Among the relics discovered during the excavations were stone tools, weapons—considered by geologists to date back to 1,400 B.C.—and the remains of a forest; the nature of these discoveries giving rise to the belief that the Ibernian tribes inhabited the valley during the Neolithic Age.

When the Celts introduced the Bronze Age into this country, they conquered the Ibernians and drove them inland. These Celtic invaders in their primitive ships were probably the first navigators of Southampton Water. It is generally assumed that they used their craft for carrying on commercial intercourse with their French neighbours across the Channel, and they are regarded as the pioneers of the trade of Southampton. Later the Greeks and Phœnicians came searching for tin. The Romans, in an unsuccessful effort to conquer Britain, are believed to have landed troops by way of the River Antona, as Southampton Water was then called, in A.D. 43. Nevertheless the legions of the Emperor Claudius became master of the whole neighbourhood, and established a capital city called Venta Belgarum, which eventually became Winchester, about 12 miles distant. At that time the River Itchen was navigable from Southampton to Winchester, and the Romans therefore built a fortress on the east bank of the river to guard the approach to the capital, and possibly also to protect the port. This fortress was called Clausentum, and the remains of it may still be seen.

The definite rise and prosperity of Southampton commenced with the Norman Conquest, and Continental traders soon recognised the advantages of the port as a centre for the trade they hoped to establish with England. The commerce of those days consisted largely of importing wine and exporting wool, and when Henry II married Eleanor of Poitou in 1150, the wine trade settled at Southampton. The older part of the town is still honeycombed with wine cellars, many of which date from that period. In 1250 the wool trade was also established at Southampton. The office of "peysage" or wool weigher was a very important one, usually held by a great personage of noble rank, and the Earl of Warwick was one of the first to occupy the position. The "Weigh House," later called the "Wool House," built in the 14th century just within the line of the old Southampton town walls, is still standing.

Trade with Venice, Genoa and Spain, and commerce with the East, was established about 1325, and eventually Southampton became the centre of all trade with the Levant. Many merchants from Genoa settled in the town, and in 1379 one who was particularly rich and enterprising said that he would, subject to certain conditions, make Southampton superior to all other ports in Western Europe. He never succeeded, however, as the London Merchants, actuated it is said by jealousy, procured his assassination while he was engaged in the negotiations to carry out his project. The remaining Genoese merchants were undeterred by the opposition of the Londoners, and in 1402 they obtained from Henry IV authority to land all their goods at Southampton. This valuable concession brought to an end the policy of a previous ruler, Edward III, by which all such trade was concentrated at Calais.



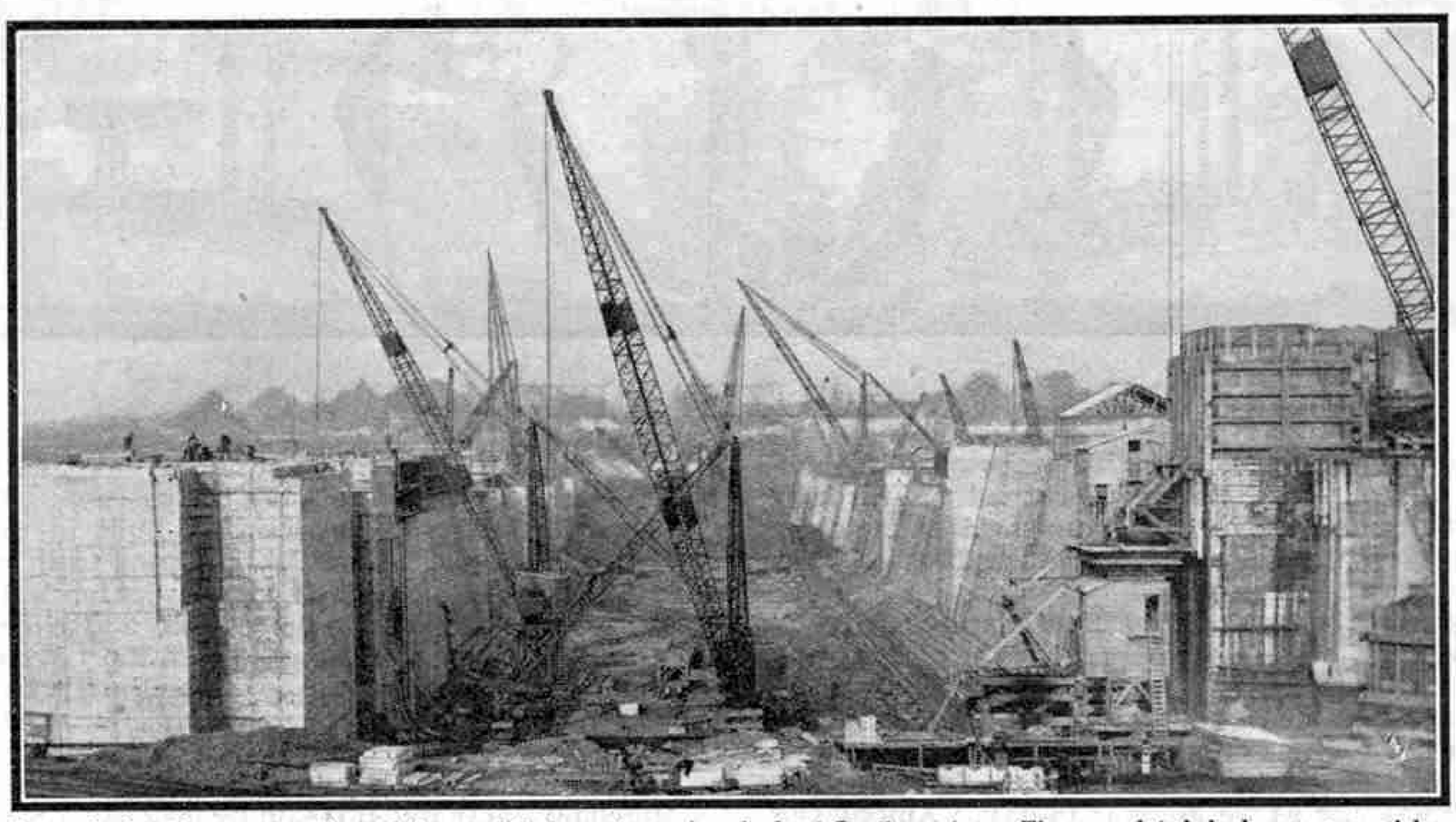
Looking down on the Southampton Dock extension works. On the right of the new quay is the large area of reclaimed land. This and the two following illustrations are by courtesy of the Southern Railway.

In 1450 Southampton ranked as the third port of importance in the kingdom, London being the first and Bristol second, and it is estimated that at that time upward of one-eighth of the whole wine trade of the country passed through Southampton. In addition to wines, large quantities of wax, honey, cotton, flax, sugar and various fruits were imported from Genoa. In 1492 a staple, or settled market, for metal was established at Southampton, and as no metals were allowed to be exported except from such centres this introduction further increased the importance and trade of the port. Southampton had long been engaged in the wool trade under similar conditions, but a recent general prohibition of wool exports had caused a decline in this trade. In 1554 Queen Mary was so gratified with her reception at Southampton, when she met Philip of Spain there, that she granted the town a monopoly to import all sweet wines from the islands of Greece.

About the end of the 16th century the trade of the port began to decline, chiefly as a result of the discovery by the Portuguese of the passage to India by way of the Cape of Good Hope. Other causes that helped the decline were the closing of the Winchester market after the suppression of the monasteries, the rise of London as a port and the establishment there of the Levant Company in the time of Elizabeth. For a period during the 18th century a considerable fish trade was carried on between Southampton and Newfoundland, but the trade of the port did not really begin to revive until the beginning of the 19th century.

An Act of 1803 established a harbour board at Southampton,

and the building of docks was considered. The sanction of Parliament was obtained, but it was not until 1836 that the Southampton Dock Company was formed. On the 12th October, 1838, the foundation stone of the first or Outer Dock was laid, and the tide was admitted into this structure on 18th June, 1842. Although incomplete the dock was used for the first time on 30th August that year, when two P. & O. steamships entered it. Through the co-operation of the Dock company and the London & South Western Railway passengers and baggage were conveyed from the ships' side to London. The dock has a water area of 16 acres and is 150 ft. wide at the entrance, and is provided with 2,621 ft. of quay. In its early days the Outer Dock was also used by the Royal Mail Steam Packet Company, for the arrival and departure of their 14 mail steamers trading to the West Indies and to South American ports. Services to France and the Channel Islands were also operated from this dock.



Scene during the construction of the world's largest graving dock at Southampton. The completed dock was opened by the King on 26th July last and christened "King George V" Dock by the Queen.

The second dock to be built by the Southampton Dock Company was opened for traffic in 1851. It is known as the Inner Dock and is the only enclosed basin on the estate. Access to it is only possible at high water, but the lock gates are able to remain open for three hours per tide, that is, about six hours each day in all, as Southampton has the unique distinction of a "double tide." The first high tide reaches Southampton Water by way of the Solent, and the second two hours later by way of Spithead. This phenomenon occurs twice every 24 hours, so that Southampton has four tides a day.

In 1856 the Union Steamship Company adopted Southampton as the home port for their steamers engaged in the South African trade. This step taxed the dock accommodation to the utmost, and to meet the emergency the Southampton Dock Company built a further 1,756 ft. of quay on the west side of the River Itchen, and this was opened for traffic in 1876. The quay originally had a depth of 20 ft. at low water, but with the increasing size of ships it was increased in 1905 to 30 ft. at low water of ordinary spring tides; and at the same time it was considerably widened.



The 150-ton Floating Crane alongside the Union Castle liner "Carnarvon Castle" at Southampton.

The trade of the port continued to increase, and eventually the dock company had to provide additional accommodation. The construction of a new and larger dock was commenced in 1886 and completed four years later. It was named the Empress Dock and opened by Queen Victoria on 26th July, 1890. The Dock has a water area of 18½ acres, an entrance width of 165 ft., and a depth of 39 ft. at high water of ordinary spring tides; and has 3,809 ft. of quay. By this time still further accommodation was urgently needed, but the raising of the necessary funds proved difficult, and the Southampton Dock Company therefore approached the London and South Western Railway with a view to them taking over the dock undertaking. The negotiations that followed resulted in the railway company becoming the sole owners and managers of the Southampton Docks on 1st November, 1892.

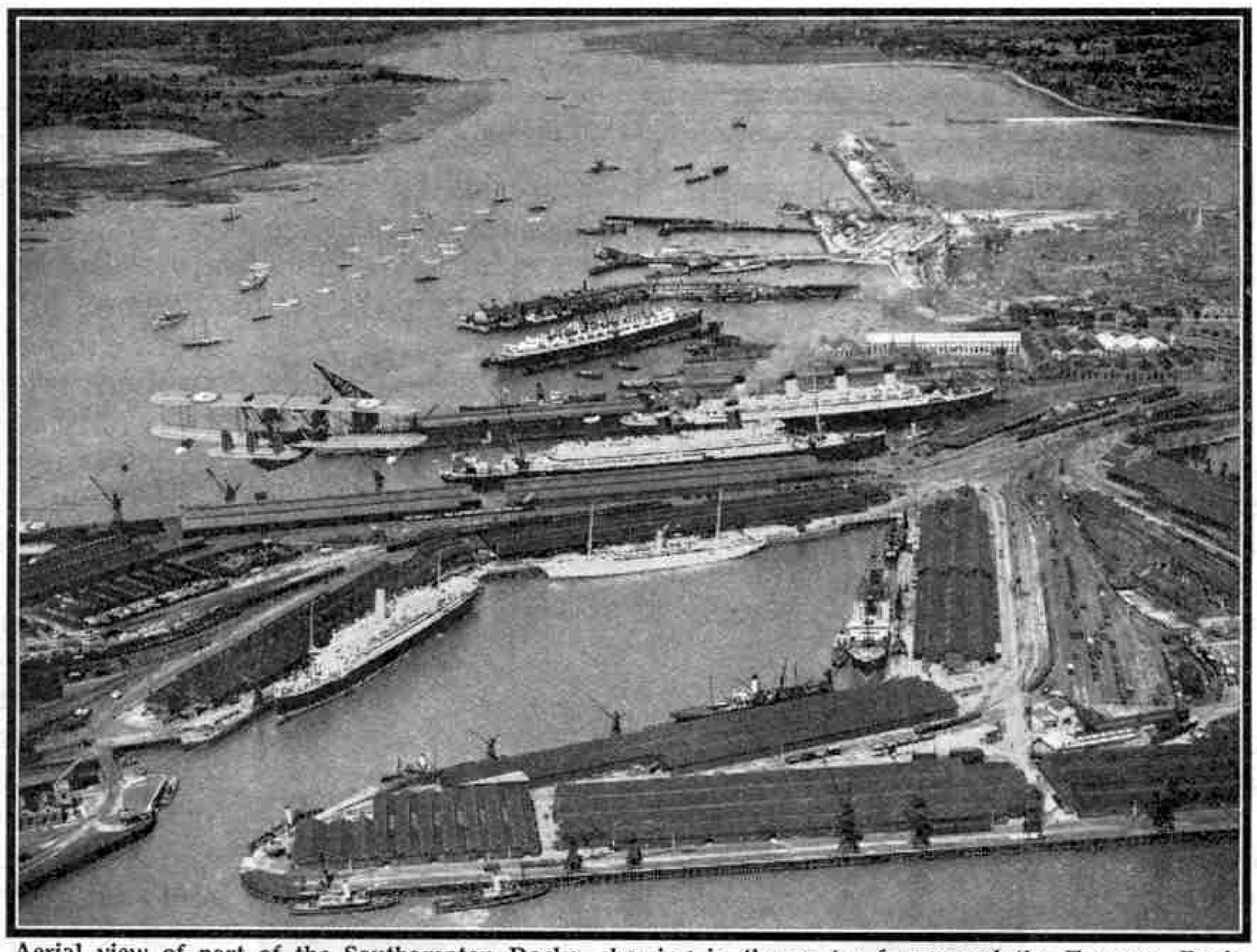
The London & South Western Railway immediately took steps to increase the accommodation and to modernise the equipment of the docks, and from that time the progress of the port has been extraordinarily rapid. One of the first works undertaken by the new owners was the construction of additional quays. The Itchen quays were completed by 1895 and added another 1,951 ft. of quay to the dock estate; and the South quay and Test quays were completed by 1902, making another 4,645 ft. of quay available to shipping.

In 1907 the White Star Line transferred their New York service from Liverpool to Southampton. This change made it imperative that further dock accommodation should be provided at Southampton, and the construction of another deep-water dock was decided upon. This dock was finally completed in 1911 and, being intended primarily for the ships of the White Star Line, was named the White Star Dock, but in 1922 this title was altered to Ocean Dock. It has an area of 15½ acres, a quay frontage of 3,807 ft., and a depth of water of 40 ft. at low water of ordinary spring tides, which is sufficient to enable the largest vessels afloat to berth at any time irrespective of the state of the tide. The accommodation at this dock is used almost exclusively by the White Star, Cunard and United States Line services, and it is from this dock that the world's largest vessels—the "*Majestic*," "*Berengaria*" and "*Olympic*," etc., of the trans-Atlantic services—regularly depart. It is not an uncommon sight to see four of these vessels berthed at one time, and on occasion over 220,000 tons of shipping have been accommodated in the dock.

When the grouping of the British railways took place in January 1923 the London & South Western Railway became part of the Southern Railway, who thus became the owners of the Southampton Docks. The Southern Railway found that further extensions were necessary if the docks were to keep pace with the ever-growing demands of shipping, and in 1924 a huge scheme of dock extensions was decided upon. The work was commenced in 1927 and the greater part of it is now in an advanced stage of construction. The portion of the work now in progress includes the reclaiming of upward of 400 acres of tidal mudland on the landward side of a new deep-water quay wall 7,000 ft. long. This wall is being built across the bay of the River Test, and will accommodate eight of the largest liners afloat. When the reclamation is complete 116 acres belonging to the Southampton Corporation will be transferred to that body, and the remainder will be occupied by dock premises and industrial works. The water approach to the quay is by way of a new

deep-water channel two miles long, 600 ft. wide and 35 ft. deep at low water of ordinary spring tides. The excavation of this channel involved the dredging of 20,000,000 tons of earth and gravel from the bed of Southampton Water. The dredged material was separated, part of the gravel obtained being used for concrete and the remainder for embankment purposes; the soft mud being taken out to sea in barges and deposited, and the sand and clay used in the reclaiming of the 400 acres of mudland already mentioned.

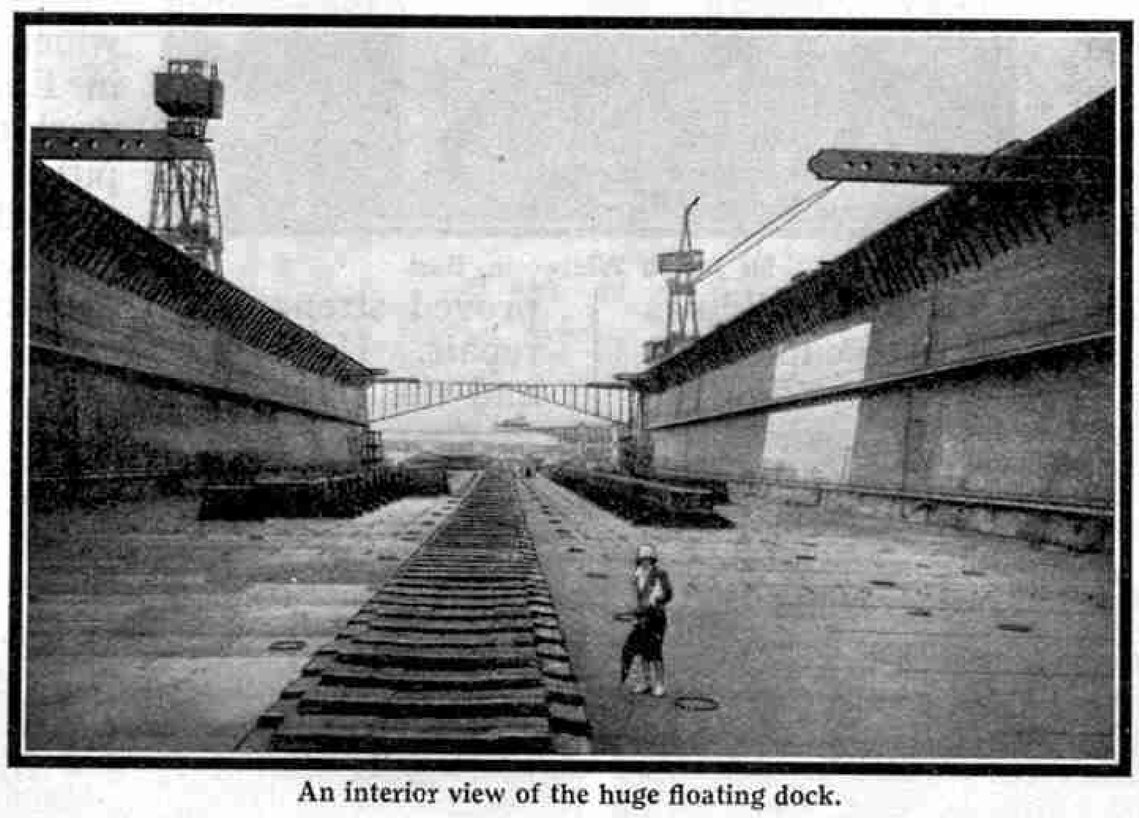
Ships, like every other means of transport, have periodically to be overhauled, and at Southampton there are seven graving docks and a floating dock provided for the benefit of the ships using the port. The first five of the graving docks were built during the period 1846–1895, and vary in length between 281 ft. and 745 ft. The sixth graving dock, known as Trafalgar Dock, was completed in 1905, and at the time of opening was the largest dry dock in the world. It has since been lengthened and widened, and is now 912 ft. 3 in. long and 100 ft. wide at the entrance. This important dock has a depth of water over the sill of 35 ft. at high water of ordinary spring tides.



Aerial view of part of the Southampton Docks, showing in the centre foreground the Empress Dock. Photograph by Charles E. Brown, London.

Provision was made in the new docks extension scheme described in the previous paragraph for two huge graving docks at the Western end of the extension, but only one of these have been constructed, and this was opened by the King on 26th July last, and christened "King George V" Dock by the Queen. It is the largest of its kind in the world, and is 1,200 ft. long, 135 ft. wide at the entrance and 59 ft. high from floor to coping. The construction of the dock involved the excavation of 2,000,000 tons of earth, and approximately 750,000 tons of concrete have been used in building the walls and floor. Although constructed primarily to accommodate the new Cunarder upon which work has been suspended since December 1931 the dock is large enough to house a vessel of 100,000 tons, should such a monster ever be built.

The floating dock at Southampton, officially opened by the Prince of Wales on 27th June, 1924, is of record size. It has an overall length of 960 ft., and the depth of water over the keel blocks is 38 ft. To give some idea of the magnitude of this vast structure it may be mentioned that it covers an area of about 3¼ acres; that the height of the dock from the bottom of the pontoon to the top deck of the side walls is over 70 ft., and that the berth in which it is placed has been dredged to a depth of 65 ft. The dock can accommodate ships of 60,000 tons displacement, and in it nearly all the biggest ships of the world have at some time been accommodated.



An interior view of the huge floating dock.

Southampton is the premier passenger port of Great Britain, and during 1932 approximately 520,000 persons were embarked and disembarked at the docks of the port, while the gross tonnage of vessels entering totalled 14,374,555 tons. In one day last year as many as 30 liners left the docks, representing a total of 341,768 tons. Owing to the natural advantages of double tides and safe dockage at any hour, and the provision of ample facilities, it is possible at Southampton to deal with large numbers of liners, irrespective of size, without any congestion.

Throughout the summer months of June, July, August and September the volume of passenger traffic at Southampton is very great, as in addition to the Continental holiday-makers, the American season is then at its height. The annual "American invasion" is well-known, and during June and July it is quite common for several thousands of passengers to land at Southampton in the course of a day. In August and September the return westward is equally pronounced, and at times more than 20 special trains leave Waterloo Station, London, daily to convey intending passengers to the port.

Although Southampton is so eminent as a passenger port, every facility is provided for cargo working, and since coming into the hands of the Southern Railway, the whole of the equipment on the dock estate has been brought up-to-date. Electric cranes of the most modern type and ranging from 2 tons to 50 tons lifting capacity are in general use. In addition there is a large floating crane, the main hoist of which is capable of lifting 150 tons on two hooks at a maximum radius of 106 ft. The auxiliary hoist of this crane is capable of lifting 40 tons at 131 ft. radius, and there is also a traversing trolley, fitted with a hoisting gear for 10 tons, running the length of the underside of the jib. Electric trucks are extensively used at the docks, and there is a fleet of motor lorries for express transit within the estate and to the surrounding districts. The 42 miles of railway at the docks connect all the quays and warehouses with the main line system of the Southern Railway, and enable boat trains to run right alongside the liners.

From Southampton regular shipping services reach all parts of the world, and each Continent contributes to the commerce of the port. The produce of every clime is handled over its quays, and goods are shipped for destinations equally as widespread. Each vessel entering is catered for according to its freight, and accommodation is available for every variety of merchandise. From South Africa come wool, hides, skins, maize, meat, fish and fruit. Enormous quantities of oranges and grape fruits are received in season, the total last year being as much as 1,624,168 packages. Soft fruits are received in even greater quantity, and the huge total of 2,321,581 packages were received during 1932. There is every prospect that this figure will be exceeded this year, as during the first two months alone 1,358,747 packages of grapes, peaches, plums, etc., were landed. The Argentine sends regularly shipments of chilled and frozen meat, butter, etc. These commodities are also received from Australia and New Zealand. Grain and timber imports bring Southampton into touch with such distant and diverse countries as Russia—from the Black Sea to the White Sea—Australia, South America, the Gulf Ports and British Columbia. The importing of oil is also a growing branch of the trade of the port.

It should be mentioned that the Southern Railway do not control the harbour. This is under the authority of the Southampton Harbour Board, which is responsible for the buoying, lighting, dredging, maintenance and improvement of the harbour.

We are indebted to the courtesy of the Southern Railway for the information contained in this article.

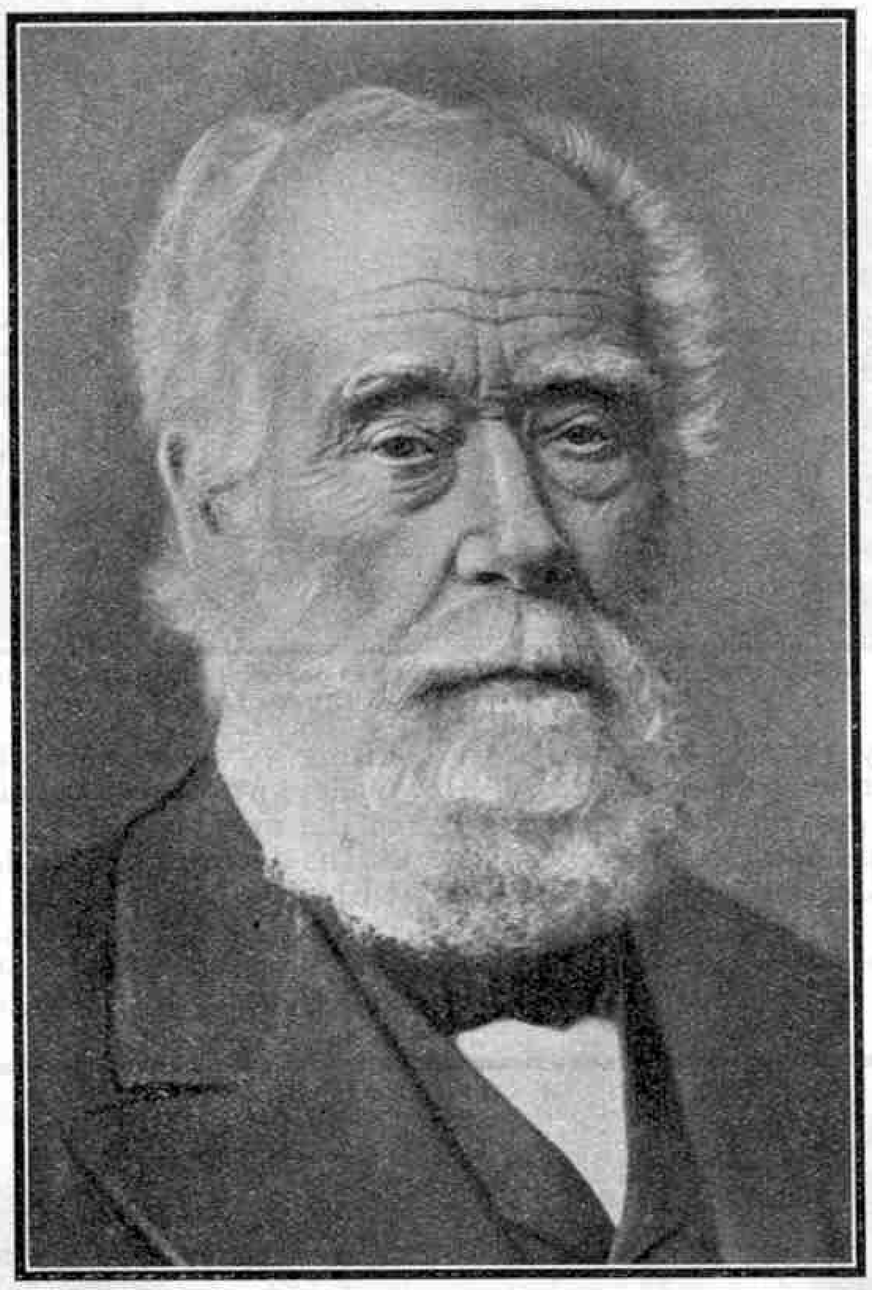
Sir Joseph Whitworth

A Pioneer of Accuracy in Engineering

IN this article we outline the career of Joseph Whitworth, one of the founders of the present great Armstrong Whitworth organisation, and famous as the engineer who developed machine tools to a perfection previously believed unattainable.

Whitworth was born at Stockport on 21st December, 1803, and educated at Idle, near Leeds. At the age of 14 he entered his uncle's cotton mill, near Ambergate, to learn the business of cotton spinning with a view to becoming ultimately a partner in the concern. After a few years he deserted this form of activity and began the study of mechanics and machine manufacturing in various factories in the Manchester district. Later he moved to London, where he served for some time with Maudslay at Lambeth, and also with Holtzapfel and Clements, famous machine tool makers of their day.

In 1833 Whitworth returned to Manchester and commenced business as a master mechanic in a small shop under the sign " Joseph Whitworth, Toolmaker from London." In the following year, success attending his efforts, he established himself on a larger scale in a mill alongside the Rochdale Canal, with offices in Chorlton Street adjoining. Extension followed, a branch canal was filled up, and older buildings and streets were absorbed, until the works occupied the whole area bounded by the Rochdale Canal, Chorlton Street, Rifle Street, Granby Row and Sackville Street. In 1880 he moved to Openshaw, about two miles east of Manchester, where new works were built on a greatly enlarged scale.



Sir Joseph Whitworth, Bart.

It was during his sojourn with Maudslay in London that Whitworth invented his method for producing the true planes, or "Surface Plates," which was his first really notable achievement, and with which his name has ever since been associated. Prior to his discovery the accepted method for obtaining such surfaces was by rubbing two surfaces together with some abrasive material between them. Whitworth showed that this procedure was incorrect, and that it generally made the surfaces more inaccurate than they were originally. He demonstrated that his method of scraping the high spots from each of three or four surfaces, rubbed together alternately, was the only mechanical means by which true planes could be secured. The "Surface Plates" so made were of such accuracy that if one of them was placed over the other so as to exclude air, the two plates adhered together with considerable force, owing to atmospheric pressure. Here possibly may be found the origin of the present Johannsen gauge blocks.

Whitworth was unquestionably the pioneer of standardisation and interchangeability in engineering. Realising the confusion that existed even in such basic essentials of engineering as screw threads, which were cut largely according to the whim of the particular manufacturer, he worked at, and eventually effected, the standardisation of screw threads, developing the thread that bears his name and which is now practically universal in England. As a result of this work the large variety of form and pitch of thread previously employed became obsolete, and he effected great economy with improved strength and facility of interchangeability and repair. His system was at once adopted by the railways and the chief engineering establishments of the United Kingdom, and was introduced into the Royal Dockyards in 1841.



The Whitworth Memorial Medal, struck in 1883, that is presented to all winners of the Whitworth Scholarship.

This standardisation of screw threads led to the standardisation and interchangeability of other parts and, in consequence, to the enormous acceleration of engineering development during the past century.

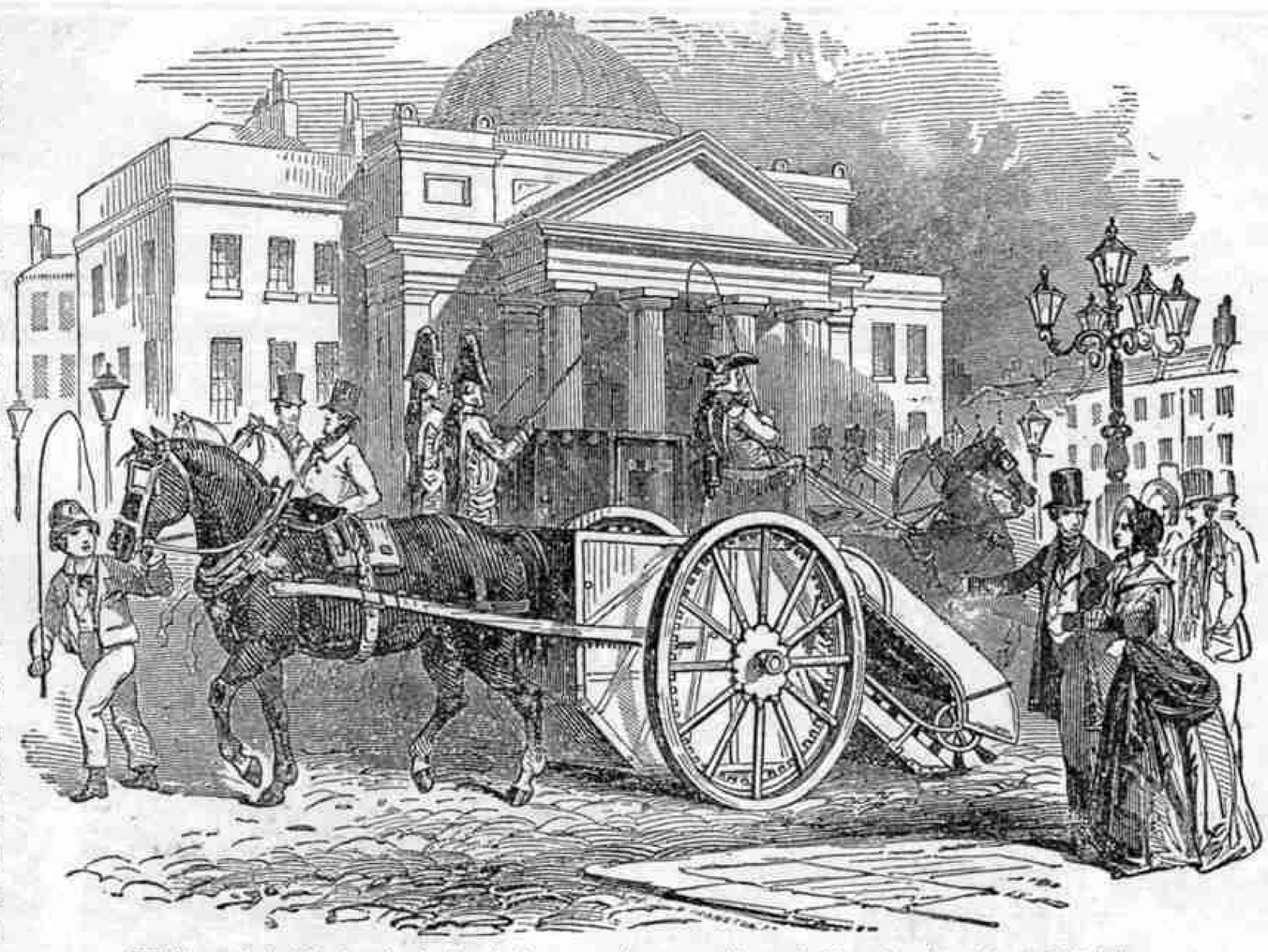
About 1833 Whitworth realised the need of some device to enable him to test with accuracy the distance between two parallel planes. With his usual initiative he attacked this problem from an entirely new angle, and produced a machine that was capable of measuring with an accuracy

of one ten-thousandth part of an inch. This hitherto incredible degree of accuracy was attained by the adoption of a principle that employed the sense of touch rather than that of sight, his investigations having led him to the conclusion that the former sense was more reliable than the latter in the skilled worker, whose ocular estimates of the same dimension were prone to vary.

To such delicacy did Whitworth develop his measuring machines that he ultimately produced one said to be capable of detecting a difference of one millionth part of an inch. This machine, which is of more historical than practical interest, may now be seen in the Imperial Science Museum at South Kensington.

From this passion for accuracy came the Whitworth gauges. His cylindrical gauges were constituted Board of Trade Standards in 1881, and it is of interest to note that in 1905 the Standard Leading Screw Committee, after careful investigation, confirmed the accuracy of the screw gauges Whitworth produced in 1841, showing that, even after 64 years, scientific development could not impugn the accuracy of his work.

Side by side with these activities Whitworth developed his machine tool business and applied his own methods to ensuring that they should be outstandingly accurate. At the great Exhibition of 1851 his display of machine tools was acknowledged superior to that of all other makers, both in design and workmanship. To-day the Whitworth machine tool business is incorporated with that of Craven Brothers (Manchester) Ltd., in whose works the rigorous standards he set are faithfully followed.



Whitworth's Mechanical Road Sweeper in operation at Manchester about 1851-2.

Whitworth, like his great contemporary, Lord Armstrong, was drawn to the consideration of armaments by the events of the Crimean War. This war broke out in October, 1853, and in the following year Lord Hardinge, then Commander-in-Chief of the Army, applied to Whitworth for assistance in the design and manufacture of machinery for rifle making, and requested him to investigate the question of rifling generally. After grave consideration Whitworth decided to devote his energies solely to machines for manufacturing the barrels of rifles, and he commenced a series of experiments with varying lengths of bullet and different twists of rifling at an enclosed range, 500 yards in length, built for him by the Government, in the grounds of his house at Manchester.



Sir Joseph Whitworth, Bart. (second from the left) as President of the Institution of Mechanical Engineers in 1866. With him from left to right are John Penn, Robert Napier and Sir William Fairbairn, Bart., all past Presidents of the Institution.

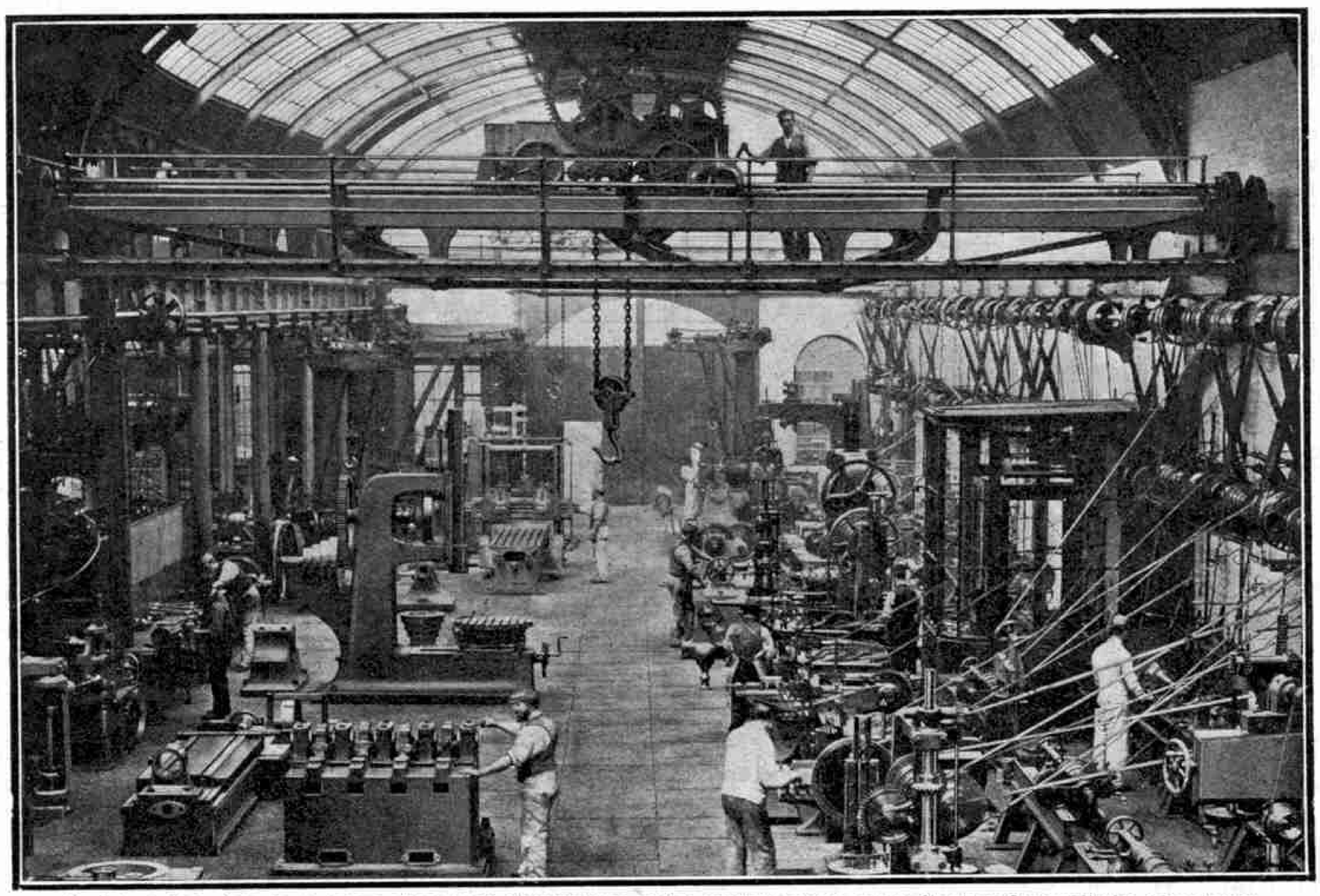
At the beginning of the Crimean War some of the British infantry were still armed with the smooth bore percussion musket introduced in 1842. This weapon, with an effective range of only 200 yards, was little better than the flint lock "*Brown Bess*" of Peninsula and Waterloo days. Some of our troops were equipped with the "Minié" pattern rifle, but owing to its many defects this was replaced, during 1855, by the Enfield Muzzle Loading Rifle of the 1853 pattern, which embodied the experience of the leading British Gunsmiths of that day.

Whitworth had no previous expert knowledge of guns or artillery, so it was natural that he should approach the designing of a rifle from a mechanical point of view. He soon realised, however, the importance of ballistics, and energetically set to work to discover by experiment the best proportions of calibre to weight of projectile, length of barrel and twist of rifling. It is noteworthy that the twist of rifling for the 3 to $3\frac{1}{2}$ calibre length of bullet that he ultimately adopted agrees with that dictated by theory. Mechanically he obtained the greatest area of rifling bearing surface for his bullet by making it fit his hexagonal section of bore; moreover, even if there was a slight amount of clearance between the bullet and the bore, the bullet would still be automatically centred immediately it began to travel along the bore.

The Government were at this time trying many weapons, but the field was finally narrowed down to a muzzle loading rifle by Whitworth, and the Enfield rifle. At the official trial that took place in 1857, the bullet of each rifle was of the same weight, but Whitworth had materially increased the power of his rifle by reducing the calibre to 0.45 inch across the flats of the hexagon, while the Enfield rifle retained a calibre of 0.577 inch. As a result of his experiments the rifling in Whitworth's weapon had been increased to one turn in 20 inches, while that of the Enfield rifle was one turn in 78 inches. Both rifles were fired from a fixed rest, and the Whitworth weapon gave results that astonished the authorities of that time. In accuracy and range of fire it completely eclipsed the Enfield rifle; in fact at 1,400 yards the deviation of the latter was so great that it could not be measured. The Whitworth rifle, however, easily attained a range of 1,800 yards with reasonable accuracy.

The first meeting of the National Rifle Association at Wimbledon, on 1st July, 1860, was opened by Queen Victoria, who fired the first shot from a Whitworth Rifle at 400 yards range, the bullet striking within 1½ inches of the centre of the target.

While Whitworth is chiefly known for his machine tools and rifles, and for his standardised system of screw threads, he must also be credited with the invention of fluid compressed steel, and as being the originator of the modern type of hydraulic forging press. Bessemer had patented a hydraulic press for this purpose, but he simply used the ordinary Bramah press with the cylinder underneath so that, when forging, the ingot was raised at each stroke. In Whitworth's press the cylinder was inverted and placed on the top so that the ingot rested on a fixed anvil underneath, an arrangement followed since by all other makers. As a matter of fact Whitworth was driven to the use of presses because of the vibration caused in the neighbourhood of the works by his heavy steam hammer.



An interesting photograph taken about 1866 showing one of the machine shops at the Chorlton Street Works, Manchester.

Whitworth was a man of great versatility, and whatever subject attracted his attention he mastered it completely. As evidence of this characteristic it is interesting to consider the mechanical road sweeping machine that he introduced about 1847. This machine was horse drawn, and not only swept the street, but lifted and carried away the debris.

Whitworth was always anxious to raise the status of engineering from a "rule of thumb" business on to a scientific basis, and with this object in view his generosity was almost unbounded. In 1868, in order to foster the education of young engineers, he founded the Whitworth Scholarships, and at his death in 1887, he created an endowment fund of £100,000 for this purpose. Probably one of the best representations of Whitworth is the Whitworth Memorial Medal struck in 1883 by Wyon, and presented to all Whitworth Scholars. The reverse of this medal shows the true planes and his measuring machine.

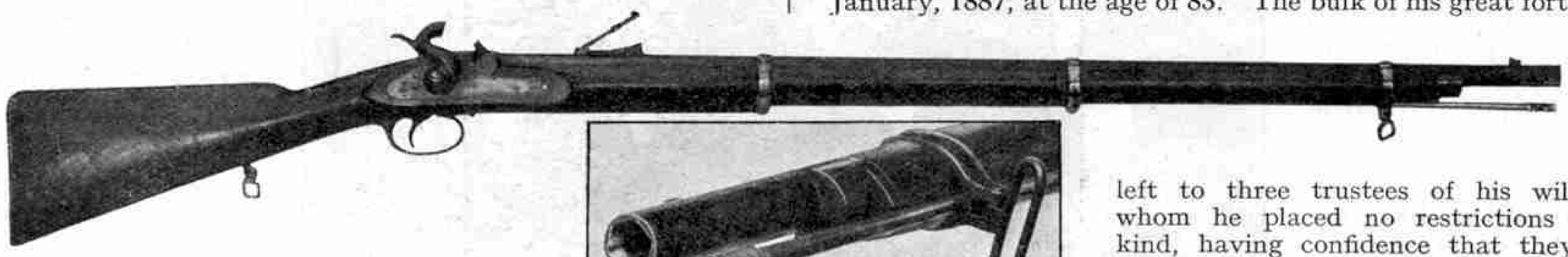
People were apt to consider Whitworth somewhat slow, but his nature would not allow him to take anything for granted, unless and until he had first proved it to his own complete satisfaction. It occurred to him, for instance, that scissors were not constructed on correct principles, and that the shearing action of one slightly bent blade over the other was mechanically unsound. To prove his argument he constructed a pair of scissors that would have delighted the heart of a master cutler. The blades of these scissors were true planes, set precisely parallel, and sliding in perfect contact each with the other. These scissors would not cut, but he had proved himself wrong by actual experiment and he was satisfied.

On this page we show an interesting old photograph of one of Whitworth's machine shops, taken in the days of the Chorlton Street Works. This shows examples of the square paper cap worn by the millwright of the period, and also shows another instance of Whitworth's passion for meticulous accuracy in small matters. It will be noted that the paving stones are all of uniform size. Each was dressed as accurately as possible to some standard dimension, so that when erecting a large machine, it was only necessary to pace out so many flag stones to arrive at the position for the temporary supports, and time and trouble in measuring up was saved.

When the Openshaw Works were built similar iron slabs were laid in the forges, and he insisted that each piece of work, as the operation upon it was completed, should be laid down on these slabs in regular order. There is a tradition that even in the machine shops chalk lines were drawn on the floor to ensure that partly finished work should be neatly and regularly parked.

It is possible that, in insisting on this orderly working, he was anticipating modern business principles, in that it enabled him to visualise at a glance the progress of the work in any particular section of the shops.

Whitworth was elected a Fellow of the Royal Society in 1857, and created a Baronet in 1869. He was a member of the Institution of Civil Engineers, the Institution of Mechanical Engineers, Hon. LL.D., Hon. D.C.L., Chevalier de la Legion d'Honneur and Commander of the Imperial Order of the Rose of Brazil, and also held the Cross of Carlos VII of Portugal. This great Victorian, Engineer, Scientist, and Philanthropist, died at Monte Carlo, where he had retired on account of his health, on 22nd January, 1887, at the age of 83. The bulk of his great fortune was left to three trustees of his will, upon whom he placed no restrictions of any kind, having confidence that they would desire to carry out his wishes in regard to its disposal. Many objects benefited from his generosity, among which were :— Owen's College (now the Manchester University) ; Manchester School of Technology ; Whitworth Institute, Art Gallery and Park ; Openshaw Baths and Library, and hospitals at Manchester, Darley Dale and elsewhere.



The Whitworth Hexagonal Bore Muzzle Loading Rifle. (Inset) A closer view of the muzzle.

It is almost impossible to over-estimate the debt that modern engineering owes to Joseph Whitworth. From his pioneer efforts have been evolved the vast army of machines of all kinds that to-day are working at high speed and with faultless accuracy to meet the world's ever-growing demands. No doubt some of Whitworth's contemporaries realised the need for mechanical precision, but Whitworth showed the way to its attainment. Of his life, over half a century was devoted to the advancement of engineering, and his great traditions are still honoured, and followed, in the Armstrong Whitworth organisation of to-day.

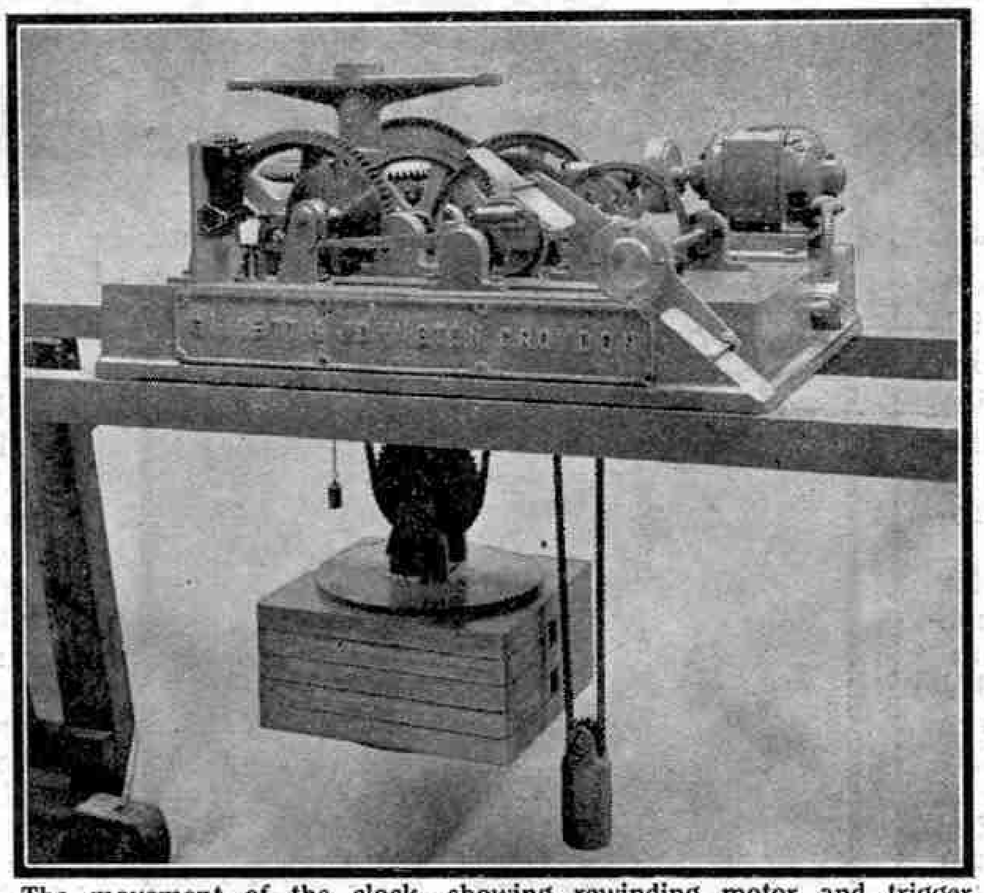
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A Giant London Clock

Notable Feature of the Shell-Mex Building

ONE of the most interesting features of the giant Shell-Mex building that towers above the Victoria Embankment, London, is the recently-completed clock. The two dials of this clock are each 25 ft. square, or 2½ ft. larger than the dials of "*Big Ben*," the famous clock in the tower of the Houses of Parliament. The minute hands of the clock are 11 ft. 6 in. in length, and the hour hands measure 8 ft. 8 in.

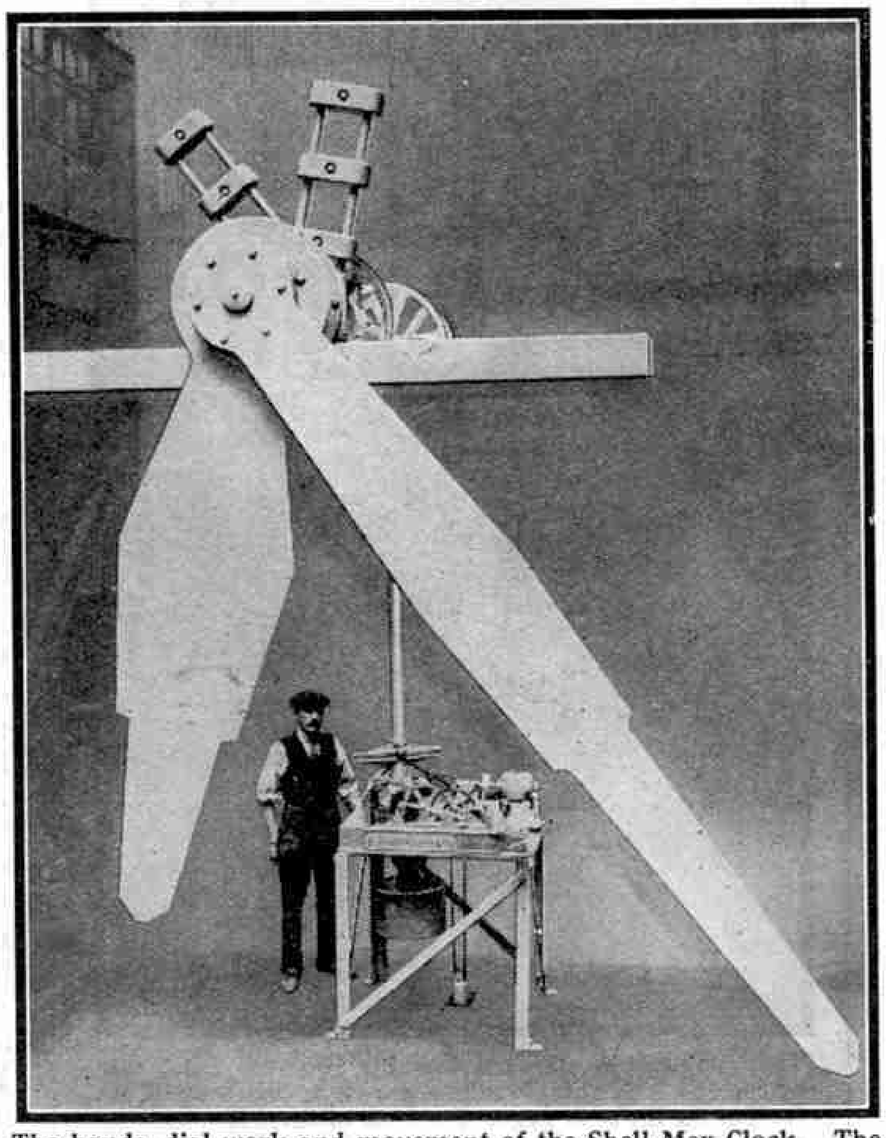
The external features of the clock have been designed in keeping with the modern architecture of the building, and the dials have been made as distinctive as possible on account of the conspicuous position they occupy. If the average person were asked to say whether the hours on a certain public clock are indicated in ordinary figures or in Roman numerals, he probably would think the matter over carefully and then decide on one or the other. Yet it is a fact that the dials of the majority of such clocks have no figures at all, and this is the case with the dials on the Shell-Mex clock. At first sight it might appear that this would cause difficulty, but actually figures are not at all necessary. Although our watches and domestic clocks have figures for the hours, we do not really read these figures when we take a quick glance to ascertain the time. We judge the time almost entirely from the relative positions of the two hands, and we have carried out this mental process so often that we are able to estimate the time just as accurately as if we took the trouble to read the figures.



The movement of the clock, showing rewinding motor and trigger mechanism.

The numerals of the Shell-Mex clock are represented by plain metal bars attached to the white stone masonry forming each dial, and are finished a matt black. It is well known that where plain strokes are used exclusively it is difficult to read the time about noon, and therefore the numerals of the four cardinal points of the Shell-Mex clock are "lozenge" shape, and are much larger than the other numerals, so that the time can be read easily. There are no minutes marked on the dials, and the numerals are placed at the extreme circumference of the dial circles, and thus are at a greater radius than if the minutes had been marked. By this arrangement the central area of the dials is considerably increased, and the visibility of the numerals and the hands is greatly improved. The numerals stand out several inches from the face of the building.

As a result of the absence of minute marks there is no continuous circle to provide a support for the hands if they deflect under extreme wind pressure, and therefore they have had to be made exceptionally strong and self-supporting. The hands are attached to steel tubes 4 in. and 5 in. in diameter respectively by means of large circular flanges, with bolts; and ball bearings are used throughout, the largest being 7½ in. in diameter. The arrangement of the tubes and ball races is such that it is impossible for water or dust to work in from outside. Grease-gun lubrication pushes a thin film of grease outward through the small spaces between the revolving flanges and spindles. The ball race castings are also attached to cast circular flanges and these are cemented into an aperture, 2½ ft. in diameter, in the wall.



The hands, dial work and movement of the Shell-Mex Clock. The illustrations on this page are reproduced by courtesy of Gillett & Johnston Ltd., Croydon.

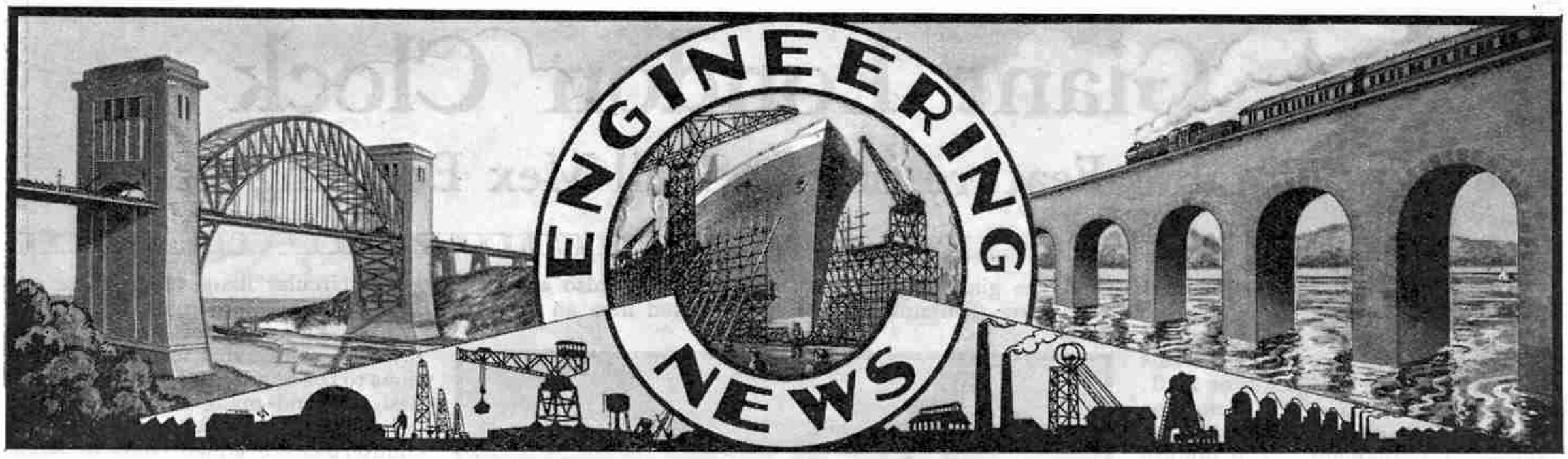
The balance weights are inside the tower so as to avoid unsightly extensions to the hands, and they have been designed and made so that suitable adjustment is always possible to counterbalance added coats of paint on the hands. The mechanism was specially designed for this clock, and the gearing inside the tower is of abnormally large calibre, with large diameter wheels to minimise back-lash. The bevel wheels are 2 ft. 2 in. in diameter, whereas even in big clocks they are rarely more than 6 in. or 8 in. in diameter; and all the universal joints are made in proportion. Ball races are used throughout, with grease-cup lubrication.

The makers of the clock, Gillett & Johnston Ltd., Croydon, to whom we are indebted for much of our information, considered that owing to the large area of the hands it would be impossible to secure accurate timekeeping with a two-seconds pendulum. They therefore designed a simple train of gears in which the motive power is a comparatively small weight of about 200 lb., that is wound by an electric motor every 15 minutes. This weight only falls about 1½ ft. between each winding, and therefore no expensive weight chutes are required. The train of gears is controlled by an electric master clock that gives an impulse every half-minute, when the hands move forward for a period of about 20 seconds and then come to rest until the next half minute release. The speed at which the hands revolve is controlled by a fan acting as an air brake and adjusted to prevent the hands moving too rapidly and coming to rest with a jerk.

The master clock that controls the tower clock is in addition to the one that controls the secondary clocks in the building, as although the magnets on the tower clock could be operated in series with these secondary clocks, it has been found more practicable in large installations such as this to separate the time-keeping parts of the tower clock from the actual motive power for the hands. Instead of a direct electrical connection, therefore, one of the secondary dials operated by the main master clock system has been placed alongside the master clock that governs the tower clock. After visual comparison this master clock is corrected when necessary. It should be mentioned that these master clocks usually keep time to within three seconds a week, and this amount is so small that it cannot be shown on the hands of a large clock. The practical result of this arrangement therefore is equal to the two systems being synchronised.

An electric bell is arranged to give notice of any failure of the current from the local supply mains. The clock will continue to run for an hour or two and it will resume normal automatic winding if the current supply is made good within this time.

The Shell-Mex clock has no bells but these can be added, together with the necessary striking and chiming units, at any time.



Largest Oil Switches Made in England

The lower illustration on the opposite page shows a three-phase Metrovick 800 amp. 161 kV oil circuit breaker with a breaking capacity of 2½ million kVA forming part of a group of 12 similar circuit breakers made by the Metropolitan-Vickers Electrical Co. Ltd., for a hydro-electric station abroad.

These are the largest oil switches so far manufactured in this country, and some idea of their size may be gained by comparing them with the pole of a 132 kV circuit breaker manufactured for the British " Grid " system, shown on the left of the illustration. The tank on each of the 161 kV switches is 6 ft. 6 in. in diameter and 20 ft. in height, and contains 1,830 gallons of oil. The 132,000-volt " Grid " breakers are 16 ft. 4 in. in height, and have an oil capacity of 920 gallons.

These circuit breakers embody a system of bushing removal developed by the Metropolitan-Vickers Electrical Co. Ltd., to enable the large condenser bushings to be inserted or removed in a short time without altering the alignment of the fixed contacts, which remain in position, and without any necessity for emptying and refilling the tanks, a long operation with such large units. One of the bushings removed from its tank is shown on this page.

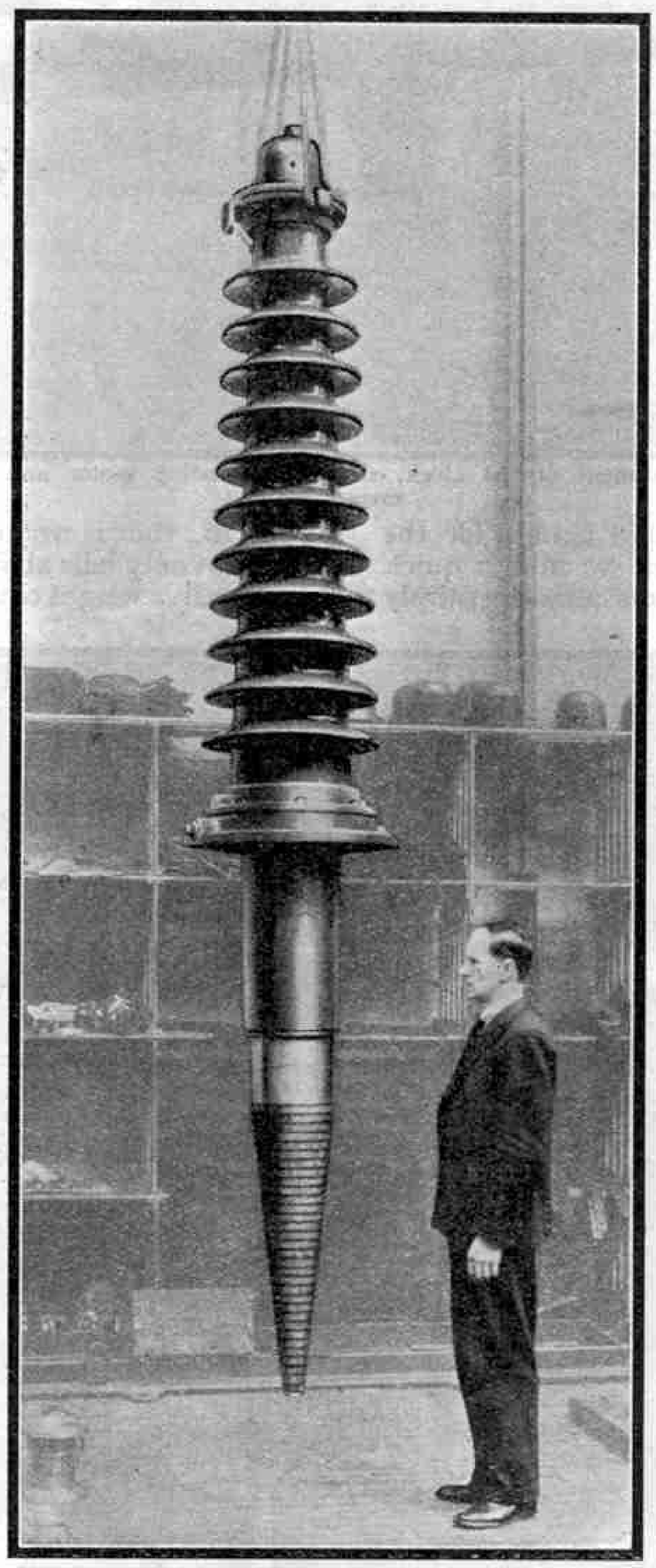
End of Scapa Flow Operations

With the safe docking of the 20,000-ton battle cruiser *"Von der Tann"* at Rosyth dockyard in July last, the salvage operations at Scapa Flow carried out by Cox and Danks Ltd. came to an end. The work of towing the *"Von der Tann"* from Scapa Flow to Rosyth occupied 4½ days, and was carried out by four tugs.

It is interesting to note that since 1924 when Cox and Danks Ltd. first commenced operations, they have raised 32 of the ex-German battle fleet scuttled at Scapa Flow. The largest of the vessels raised was the *"Hindenburg,"* a battleship of 28,000 tons.

New Tramcar for Blackpool

An interesting new tramcar now in service in Blackpool is capable of travelling at a speed higher than most tramcars, and is specially designed to give good facility for observation. The vehicle is of the single-deck type, with an entrance in the centre and has seats for 52 passengers. The body is streamlined, and is mounted on two bogie trucks. Its overall height is less than 10 ft. The car is divided into two saloons, one on each side of the central entrance platform, and each seating 24 passengers. The remaining four passengers are carried on tip-up seats on the entrance platform. At each end of the car is a totally enclosed driving compartment, entrance to which may be gained from a door on the exterior, or through another



This illustration shows a bushing removed from one of the 161 kV circuit breakers shown in the lower illustration on the next page. For both of these illustrations we are indebted to the Metropolitan-Vickers Electrical Co. Ltd.

leading from the saloon.

The electrical equipment of the vehicle consists of two motors rated at 50 h.p. at 500 volts. The current is collected from overhead wires through a small pantagraph carried on a structure built on to the car roof. The pantagraph is made of steel tubing and has several special features.

Water Cooling for Concrete Dam

In the erection of concrete structures it is customary to allow the concrete put down to cool naturally. In connection with a dam that is now being built in the United States, however, it is estimated that such a proceeding would take many years and would result in dangerous cracks; and the engineers engaged on the work are therefore cooling the concrete artificially. This is done by laying 2 in. iron pipes at intervals of 11½ ft. as the concrete is poured on to the site, and circulating cold water through the pipes. About 150 miles of this piping is being embedded in the dam.

This is not the first time that the method has been used, for when the Owyhee Dam in Oregon was being constructed a similar plan was followed. In this case the temperature of the concrete was reduced from 118 degrees to 84 degrees in the short space of time of two weeks.

World's Largest Canal Lift Lock

What is claimed to be the largest canal lift lock in the world is now rapidly approaching completion at Niederfinow, near Eberswalde, on the Berlin-Stettin waterway. The work of construction was not begun until 1930, but the lock is expected to be ready for service next year, when it will assist in speeding up traffic making use of the Hohenzollen Canal and the Oder River.

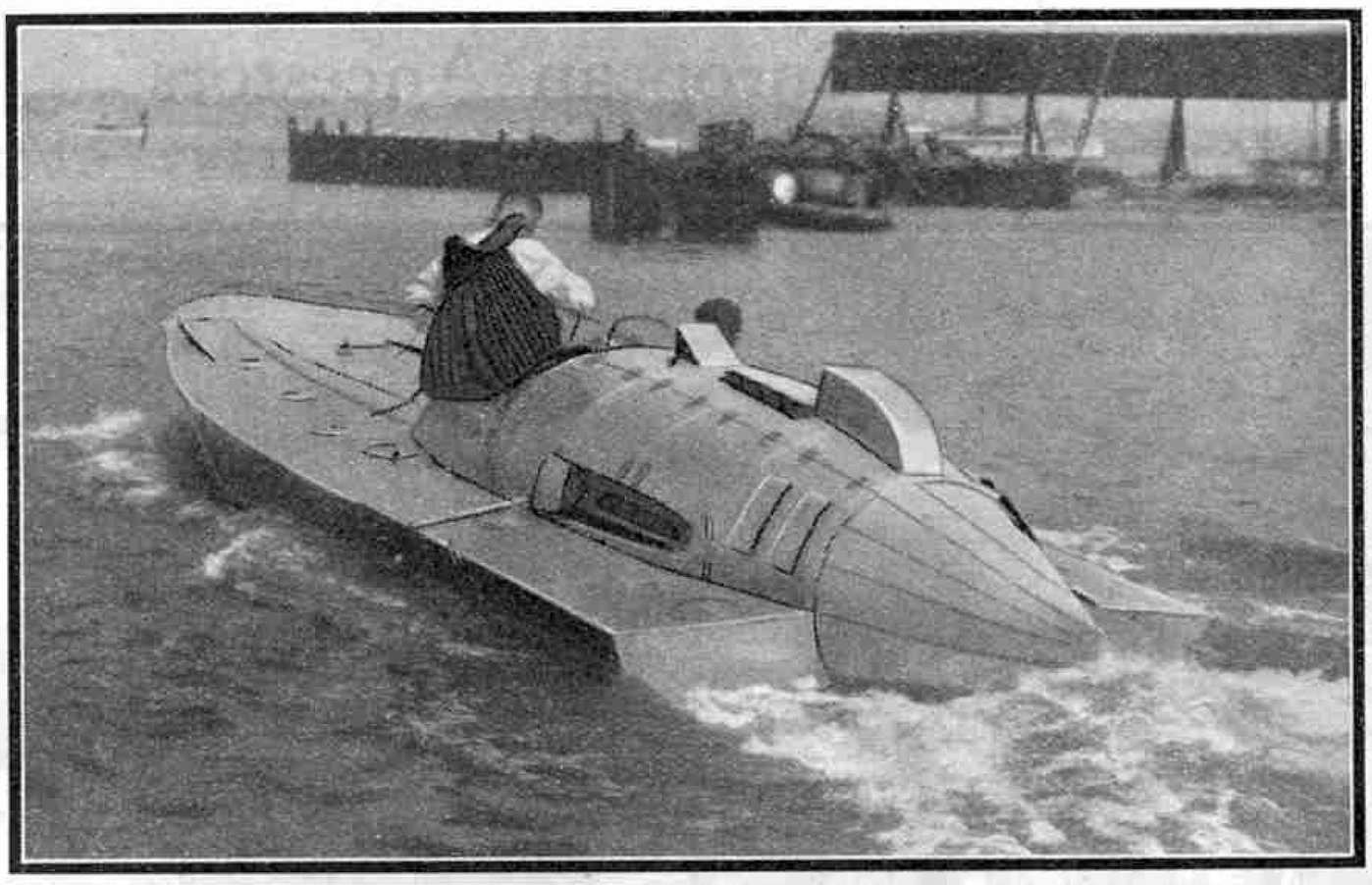
Traffic in the canal at present makes use of a flight of four locks that have a total fall of about 112 ft. Several hours are occupied in passing through them, and it is hoped that the new lift lock will reduce the time to about 20 min. and, in addition, make it possible for vessels of 1,000 tons to travel along the canal, whereas at present craft may not exceed 600 tons in displacement. The new lock is unusual in design, for the high-level canal has been extended by an elevated canal with a breadth of 92 ft. until it is directly above the low-level canal. Here a lock working on the principle of the lift has been built, the main uprights of the lift structure being 197 ft. in height.

The tank in which barges will be raised or lowered is 279 ft. long, 39 ft. broad, and 13 ft. deep. When filled with water to a depth of 8 ft., and carrying a vessel of 1,000 tons, the total weight of the tank will be about 4,600 tons. This will be balanced by a number of iron-filled concrete counterweights, so that the tank hoisting and lowering machinery is only required to overcome the resistance of the machinery and the inertia of the tank and counterweight masses. The lifting gear consists of four D.C. motors each working at 440 volts and operated by press button controls.

"Miss Britain III"

Once again Mr. Gar Wood, in his famous American speed boat *"Miss America-X"* has retained the Harmsworth Trophy by beating the British challenger *"Miss Britain III"* piloted by Mr. Hubert Scott-Paine. The British boat, which is illustrated on this page, put up a magnificent fight, and in one lap attained a speed of 86.738 m.p.h.

"Miss Britain III" is a remarkable vessel in many respects, and although she was not successful in winning the trophy for England, her performance is a much greater achievement than at first appears. In meeting *"Miss America X"* she competed against heavy odds, for her single engine is capable of developing only 1,375 h.p., whereas the American boat has four Packard engines with a total of nearly 8,000 h.p. The fact that the challenger came so near to success is therefore a high tribute to British design and engineering skill.



A stern view of "Miss Britain III," the British speed boat that made such a bold bid for the Harmsworth Trophy in the recent races in America. Some interesting details of this vessel are given on this page.

The British boat was designed by Mr. Hubert Scott-Paine, and all the construction work was carried out by the British Power Boat Company at Hythe, Southampton, to whom we are indebted for our illustration. During her trials she attained a speed of over 100 m.p.h., and thus became the first boat ever to travel at this speed on salt water. She is propelled by a single Napier engine of the 1927 Schneider Trophy type, and is the first all-metal racing boat ever built.

One of the most remarkable features of *"Miss Britain III"* is that she weighs only 2.5 lb. for each horse power of her engine. Her length is 24 ft. 6 in. and her beam 8 ft., and she is fitted with the most compact and lightest cooling system ever evolved. The gear-box for the transmission is the smallest for its horse power yet designed.

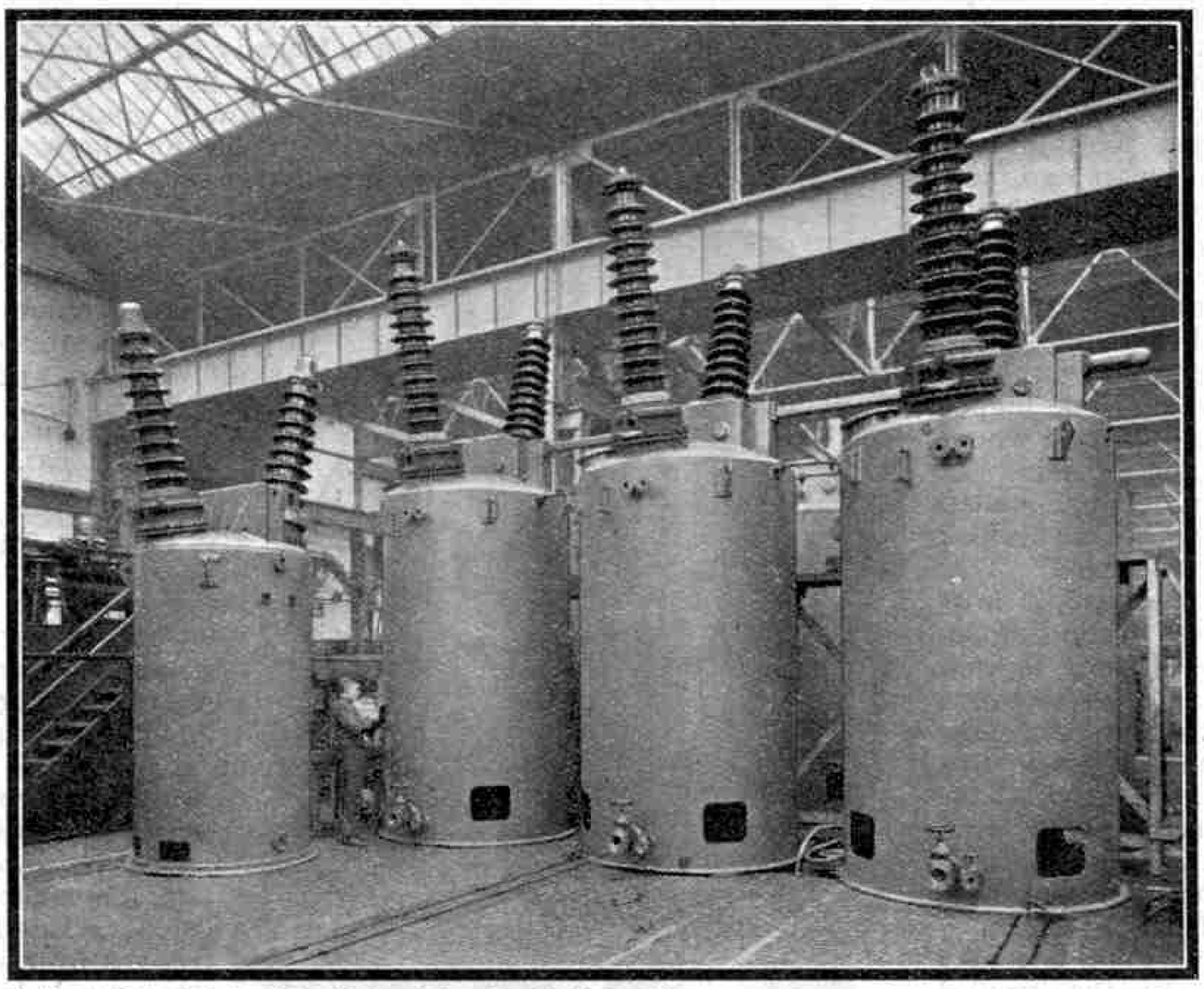
Tunnels under the Scheldt

Work is now rapidly proceeding on two tunnels that are being built under the River Scheldt at Antwerp for vehicular and pedestrian traffic respectively. The actual boring of the vehicular traffic tunnel was started on 9th November, 1931, and was finished in February of this year. The pedestrian tunnel, which is nearly three-quarters of a mile up the river from the one intended for vehicles, has also been bored, and both tunnels are expected to be completed before the specified time, which is about March 1934.

The vehicular tunnel is the longer of the two, being 2,308 yd. in total length, with a roadway 22 ft. in width. Inside the tunnel the height from road to roof is 14 ft. 9 in. All impure air is carried away through a duct above the roof, fresh air being carried along beneath the floor and fed through openings at each side of the road. The tunnel is in three main constructional sections, consisting of two open approaches, two reinforced concrete tubes, and a central section, or tunnel proper, which is lined with cast iron. The two approaches are each 186 yd. 2 ft. in length, and have a gradient of 3.5 in 100. They are of reinforced concrete and, owing to the loose nature of the soil over which they are built, each ramp is supported on special foundations.

The concrete tubes forming the next section were built in position and were then covered in. This was probably the most dangerous undertaking of the whole work as the cuttings for the tubes had to be made to a depth of 65 ft., close to the bank of the river, where there were found to be intermediate water-bearing strata that might have flooded the workings. This difficulty was overcome by driving sheet piles along each side of the cuttings, and by sinking electric centrifugal pumps to a depth of 90 ft. to drain thoroughly the course of the work. The two tubes are not equal in length, one being 307 yd. and the other 277 yd. The shorter one could not be lengthened, as it was impossible to continue the cutting, and so boring had to be resorted to. The cast iron tunnel proper is 1,351 yd. in length and was driven with the aid of a shield 275 tons in weight. It is lined with cast iron segments bolted together. The tunnel has an outside diameter of 30 ft. 10 in. and an inside diameter of 28 ft. 5 in.

The pedestrian tunnel was also shield driven. It is perfectly straight and is only 630 yd. in length, with an inside diameter of 14 ft. Pedestrians enter or leave by means of escalators at each end. The total cost of the two tunnels is estimated at about £2,171,000.



A three-phase Metrovick oil circuit breaker built in this country for a hydro-electric power station abroad. A 132 kV circuit breaker in use on the British "Grid" system is shown on the left for purposes of comparison.

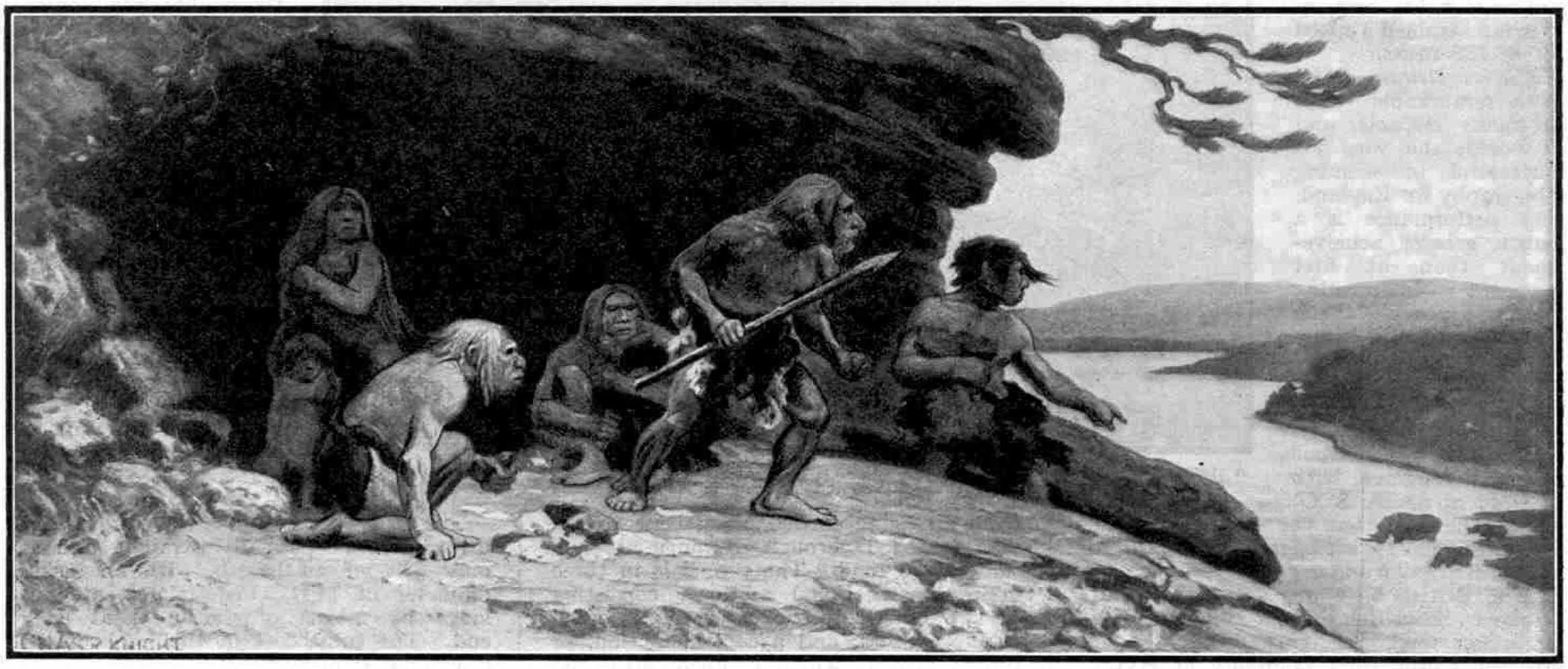
World's Heaviest Vertical Lift Spans

A new bridge across the Hudson River that has recently been opened, and which connects Troy and Menands, in the State of New York, is one of the two heaviest bridges of the vertical lift type in the world. The other bridge crosses the Hudson at Albany, New York, and was opened last winter. In both cases the movable spans are 341 ft. in length and 2,700 tons in weight. The span on the Troy–Menands bridge is raised and lowered by two General Electric 250 h.p. shunt-wound motors operating at 410 r.p.m.

The controls for the bridge are concentrated in a switch house mounted above the centre of the movable span, where the operator has an unobstructed view of both bridge and river. As a safety precaution the entire system is interlocked, so that the span cannot be raised until the gates at both ends are in position and the traffic signals for motorists have automatically turned red. When the span reaches the top of the towers, 77 ft. above the bridge level, a signal to proceed is flashed to boats on the river. The whole of the electrical equipment for the operation of the bridge was designed and built by the General Electric Co. of New York.

The Story of Prehistoric Man

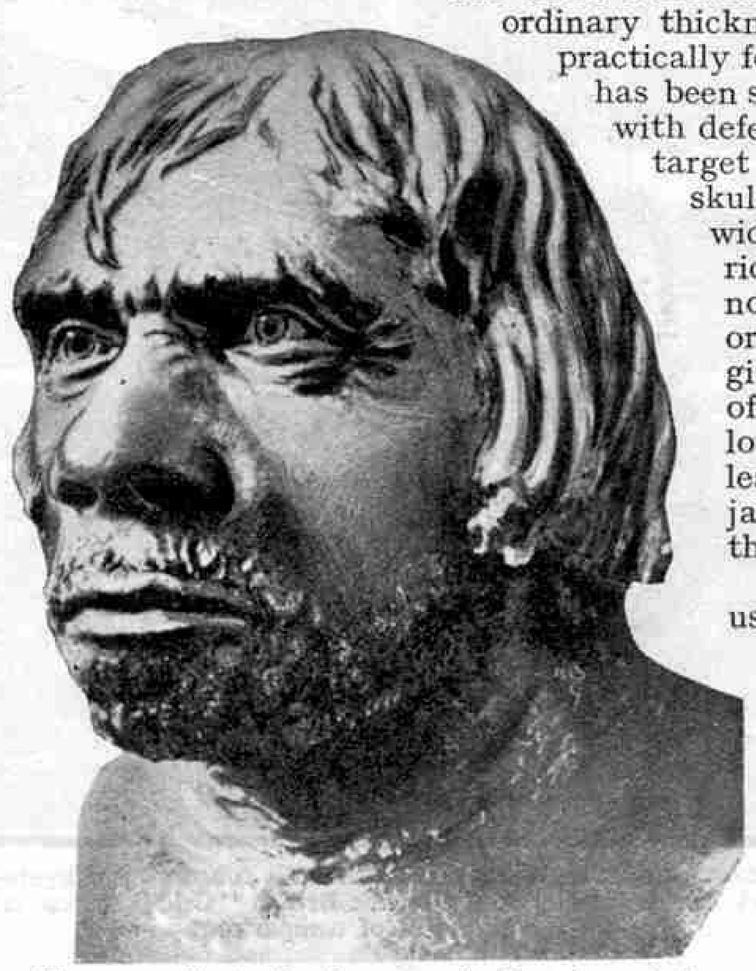
II.—Our European Ancestors



LAST month we told the story of the discovery of Java Man and Peking Man, two interesting beings of many thousands of years ago who are regarded as the earliest approaches to humanity. Java Man appears to have been more of an ape than a man, but Peking Man was definitely human, for he had mastered fire and had learned to chip rude stone tools. He probably lived about a million years ago, and almost his only rival for the distinction of being the earliest real human being is a creature who lived in Great Britain. The few remains we have of this primitive European race consist of broken fragments of a skull, but these are sufficient to enable us to recognise in their original owner a being who was a little higher in the scale of evolution than the two whose fossilised bones have been found in Asia.

The earliest European human being is called Piltdown Man, from the name of the Sussex Common where his bones were found. This Common lies in the valley of the Ouse, a short river flowing through the Weald to the English Channel at Newhaven. The district is rich in remains of prehistoric animals, and when a new gravel pit was opened there in the early years of the present century, the workmen were asked by Mr. C. Dawson, a local resident interested in fossils, to preserve any unusual bones discovered in it. For a few years a small portion of a human skull bone was all that was revealed, but in 1911 Mr. Dawson's patience was rewarded by the discovery of a larger piece, apparently belonging to the frontal portion of the same skull. This aroused hopes of further important finds, and a careful search of the gravel pit eventually brought to light a fossilised jaw and other fragments of the skull of a being who was recognised as Great Britain's earliest known inhabitant.

These remains of Piltdown Man were accompanied by the fossilised teeth of a prehistoric elephant and bones of other animals now extinct. These creatures would have flourished best in a fairly warm climate, and the earliest Briton almost certainly lived in broad valleys covered with grass land or marshes and surrounded by forest-clad hills. The site in which the fragments of his skull were found probably was once the bed of the Ouse, which is now a mile or two away, and it has been suggested that the bones are evidence of a tragedy of by-gone ages, when one of the primitive human beings then living in the neighbourhood was drowned. The decay that followed would be assisted by the rush of water, which was responsible for the scattering of the remains.



The upper illustration is a reproduction of a painting by Charles R. Knight of Neanderthal cave dwellers ; the lower one shows the probable appearance of Neanderthal Man, a restoration by Dr. J. H. MacGregor. For permission to reproduce these illustrations, and the lower one on the opposite page, we are indebted to Dr. J. H. MacGregor and the American Museum of Natural History, New York.

The most remarkable feature of Piltdown Man is the extraordinary thickness of the bones of his skull, for these are practically four times as thick as those of modern Man. It has been suggested that Nature had thus furnished him with defensive armour, for clearly his head would be a target for the stones and clubs of enemies. His skull was low and narrow in front, and was widest and highest at the back. Thick bony ridges projected above the eyes. These were not so strongly marked as those of Java Man or Peking Man, but were sufficiently bold to give him an aspect quite different from that of modern human beings. He had a heavy lower jaw, and this seems to have been the least human part of his make-up, for both the jaw and the teeth remaining in it resembled those of a young chimpanzee.

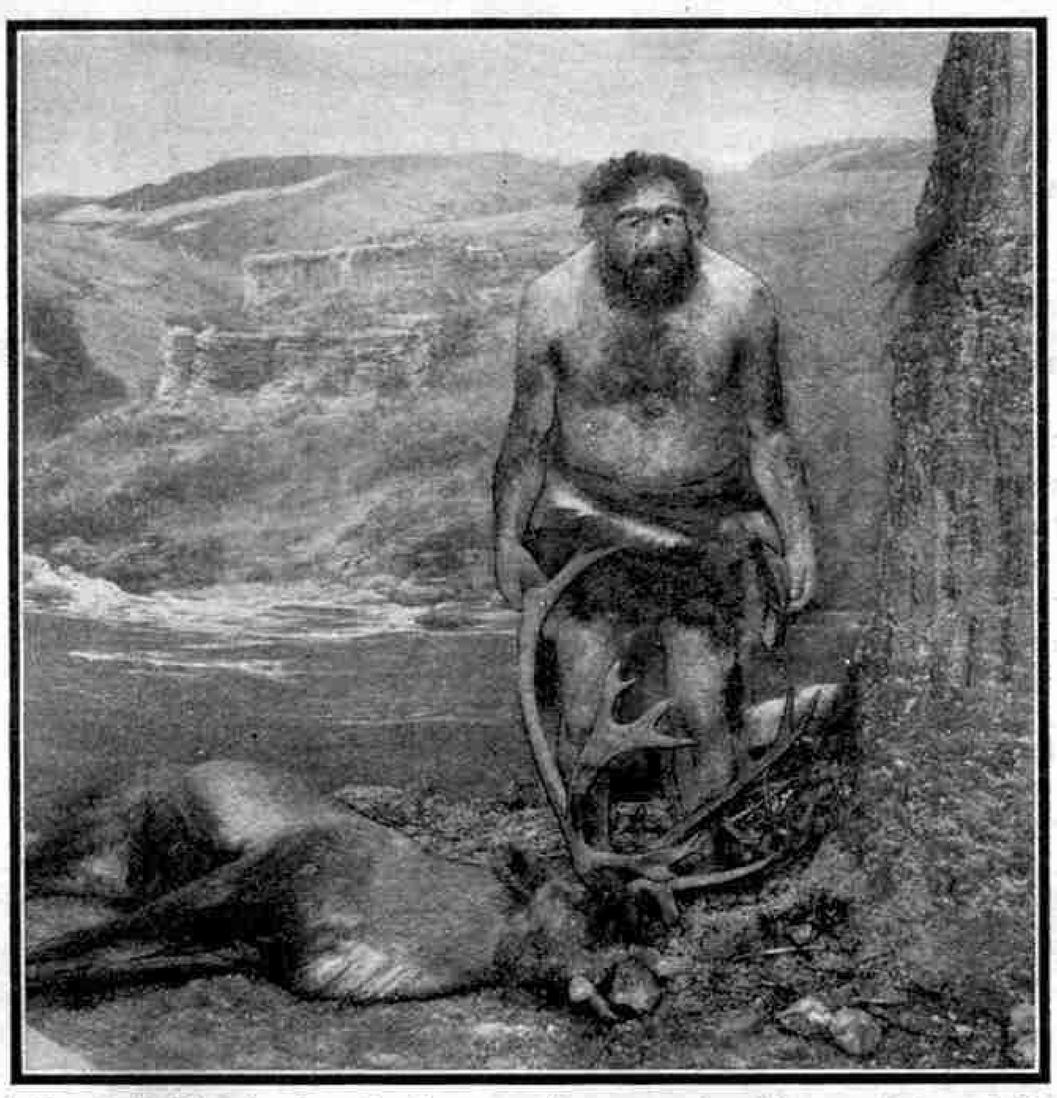
Although the remains are so scanty, they tell us something of the appearance of this earliest known European. A cast of the inner surface of the skull shows that his brain measured about 1,200 c.c. Thus it was small in comparison with that of the average modern Englishman—whose brain capacity ranges from about 1,400 to 1,800 c.c.—but was much larger than that of Java Man. Mere size of brain is of little importance in estimating intelligence, however, and it is more interesting to realise that the shape of the cast shows that the lobes of the brain governing powers of speech were fairly well developed. Piltdown Man was certainly intelligent, for along with his remains were discovered chipped flint tools, including scrapers and borers and a rude form of axe.

The discovery of Piltdown Man illustrates the difficulty of collecting remains of the most ancient of Man's predecessors. If Mr. Dawson's interest in prehistoric relics had not led him to keep a sharp eye on the contents of the newly-opened gravel pit, the

fragments would have been carted away for use in mending roads, a fate that may have overtaken the remains of many of the earliest inhabitants of Great Britain!

The remains of the next European of whom we know anything were discovered in 1907 in a sandpit near Heidelberg, Germany. All that we have of him is a single lower jaw-bone in which most of the teeth are in position. This was discovered at a depth of nearly 80 ft., in association with fossilised remains of bears, bison, rhinoceros, elephants and other animals of types now extinct; and from the position in which it was found it is clear that the fragment is very ancient.

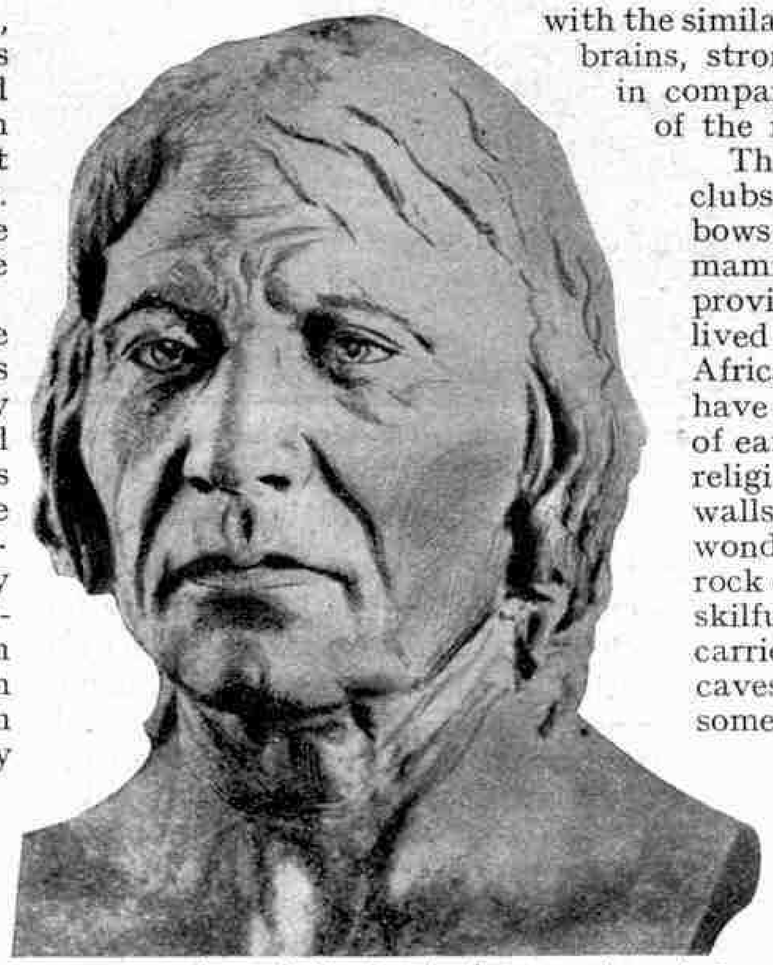
Even so small a remnant as a single jaw-bone can tell us much about the human being to which it belonged, particularly if the teeth are nearly complete. For instance, the teeth of an ape are larger than those of a human being and have wide spreading roots, while the canine teeth are very prominent. Examination of a fossilised jaw therefore shows whether the creature to which it belonged was human or apelike. In studying fossilised human remains it is possible to trace a gradual change in the size and shape of the teeth, those of the oldest and most primitive beings approaching the teeth of an ape in size, while those known to be more recent, and to have come from more intelligent beings, resemble the teeth of modern Man. Comparisons of this kind show that Heidelberg Man, the original owner of the single jaw-bone discovered in 1907, was really human, but that he was more primitive than other human beings whose remains have been found in Europe, with the single exception of Piltdown Man.



A Neanderthal hunter in natural surroundings, reproduced by permission of the Field Museum of Natural History, Chicago.

The beings whose remains have been discovered in Java, near Peking, and at Piltdown respectively, are the earliest known creatures showing human characteristics. Heidelberg Man apparently had advanced a stage further than the three more primitive races, and this may be said also of Rhodesian Man, an early inhabitant of Africa, parts of whose skeleton were discovered in a mine at Broken Hill, Rhodesia, in 1921. Although each of these primitive races is known to us from a mere handful of fossilised bones, these have been sufficient to show them to be low forms of humanity and to tell us that they were cousins of modern Man's ancestors. They have become extinct, and perhaps were crowded out by the spread of other and more capable races that came into existence.

One such race certainly spread over Europe in very early times, and skulls and other remains of its representatives have been found widely distributed between Gibraltar in the west and Palestine in the east. The first remains of this new race were discovered in the valley of the Neander in Germany, and the name of Neanderthal Man therefore has been given to it. Many similar skulls have been discovered, and practically all have been found by excavating in caves, where they are usually associated with tools and weapons chipped out of flint, and often with fragments of iron pyrites, the hard, brassy mineral from which sparks for fire-lighting purposes were struck by means of flint. Neanderthal Man undoubtedly was more capable and cultured than his predecessors. To us he would appear brutal and savage in appearance, however, for he was of stocky build and moved clumsily. His face was broad, his nose short and wide, and he had a retreating chin. His jaw was heavy and his teeth were large, while the strong bony projections above the eyes that seem to be characteristic of primitive beings could be seen, although they were not so prominent as in Java Man and other older forms of humanity.



A representation of the head of a member of the Cromagnon race, the earliest man of modern type to inhabit Europe.

Neanderthal Man was a hunter of the mammoth, the woolly rhinoceros and other extinct creatures that roamed over Europe thousands of years ago. He manufactured spear heads of flint with which to kill these animals, for he was a skilful worker in stone, and his scrapers and cutting knives of this material had edges that were carefully sharpened by chipping and flaking. Many specimens of his work have been discovered in the caves that he inhabited, and these have yielded also ashes and charcoal from his fires, and the bones that he threw aside after his meals. We owe to him much of our knowledge of the creatures that lived in Europe during prehistoric times, for unconsciously he converted the caves he inhabited into museums in which their bones were preserved for our examination.

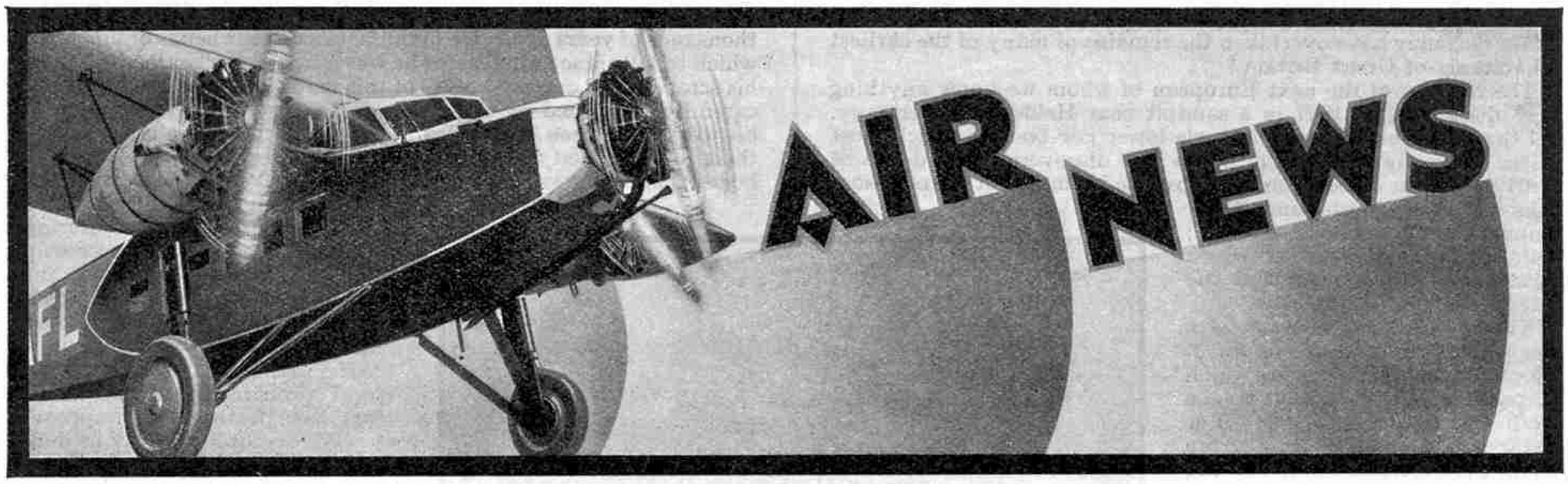
After dominating the Western World, probably for thousands of years, Neanderthal Man disappeared. We do not know why he died out, but it was certainly not for lack of brains, for the size and shape of the skulls we have recovered prove him to have been intelligent. Changes in conditions may not have suited him, and perhaps these encouraged the spread of a new race that spread rapidly over Western Europe, either exterminating or absorbing the survivors of the Neanderthal race. The men and women of this race are of special interest to us, for they are the earliest representatives of modern Man of whom we have certain knowledge. Where they came from originally is not known. They are believed to have entered Europe from Northern Africa, however, and it is interesting to find that traces of an early type of true modern Man have been discovered recently in East Africa.

The new-comers in Europe were called Aurignacians or Cromagnons, these names being derived from those of villages in the South of France near which their remains were first discovered. They were more highly civilised than the older inhabitants. Their heads were long and well-domed, and their skulls were only slightly thicker than those of human beings of to-day. Bony projections were still visible over their eyes, but were slight in comparison with the similar bones of their prededessors. They had large brains, strong and well-made jaws and robust bodies, and in comparison with Neanderthal Man a representative of the new race must have seemed graceful and agile.

The Cromagnons lived by hunting. Armed with clubs, well-made spears of flint, and serviceable bows and arrows, they chased bison, bears, mammoths and other prehistoric animals that provided them with both food and clothing. They lived in flourishing communities in Europe, Northern Africa and Western Asia, and their home life must have been on a much more generous scale than that of earlier Man, for they possesed crude forms of religion, and were vigorous and artistic. On the walls of the caves in which they lived they drew wonderful pictures of hunting scenes, while their rock carvings show them to have been astonishingly skilful and intelligent. Much of this work was carried out in the innermost recesses of extensive caves, so that the artists must have used lamps of some kind. These probably were made from pieces of stone or bone, and the fuel undoubtedly was marrow fat burned with the aid of a crude wick.

The arrival on the scene of the Cromagnons brings us to the period when modern Man begins to take his place as master of the Earth. How the first individuals of this particular type of humanity came into existence is not known, nor can we tell when they began to spread over the earth. As they developed they split up into races differing in size and colour, and also in mental capacity, just as their descendants do to-day; but in brain power, and in skill in making use of their resources, all were greatly superior to the human beings who came before them. They invented agriculture, learned to keep cattle and sheep instead of hunting, and discovered

(*Continued on page 794*)



Next Year's England-Australia Air Races

On page 601 of our issue for August last we referred briefly to a race that is to be flown from London to Melbourne next year in connection with the centenary celebrations of the city of Melbourne. We are now able to give further details of this event, which has been named the MacRobertson International Air Race after the donor of the prizes. In addition to this race another one will be flown at the same time; this will be a handicap, and will be known as the MacRobertson Handicap Race. In order to distinguish between the two they are to be known shortly as the "Championship Race" and the "Handicap Race." The first prize for the Championship Race is £10,000 and a gold cup of not less than £500 value; the second prize is £1,500, and the third £500. The first prize in the Handicap Race is £2,000 and the second £1,000.

The start of the races has been provisionally fixed for 20th October, 1934. The machines will not all start from the same aerodrome, but will be sent off from aerodromes in this country situated as nearly as possible equidistant from Baghdad. The entrance fee for the Championship Race will be £50 per machine and for the Handicap Race £10, but those who wish to enter machines for both events may do so for a fee of £50.

In both races there is no limit to the number of the crew which may be carried by a machine, but during the race no new personnel may be embarked. Every machine must carry food and water to maintain life for three days, and must be provided with approved flotation gear for every occupant, in addition to a number of smoke signals. The regulations give a list of minimum instruments that must be carried. Refuelling in the air and night flying are permitted.

In the Championship Race competitors will be required to call at Baghdad, Calcutta, Singapore, Darwin and Charleville, where their log books will be marked by officials. The same course will be flown by machines entered in the Handicap Race, but in addition to these control points checking points will be established at intervals of approximately 500 miles along the route. Landings at these checking points will not be compulsory. The time limit for the race is 16 days. Details of the method of handicapping are not available, but they will be based on a definite formula in which the pay load of the machine entered will be one of the most important factors to be takeu into consideration.



An aeroplane spraying a cotton field with chemicals in order to kill parasitic insects. Official photograph, United States Army Air Corps.

French Atlantic Flying Boat

An interesting four-engined flying boat has been built by the Blériot Company for a French air line company for a service over the South Atlantic. The machine, which is known as the Blériot 5910, is equipped with four Hispano-Suiza engines, and has a wing span of about 140 ft. and an all-up weight of about 48,500 lb. During its trial trips it was loaded to a weight of 35,600 lb., and then got off the water successfully in 17 seconds. A notable feature of the machine is the disposition of the four engines, three of which are placed on the leading edge of the wing, while the fourth drives a pusher airscrew and is situated on the trailing edge immediately behind the central front engine. This is probably one of the last machines to be built by the Blériot Company, which has now closed down because of financial difficulties.

Rafts for Aircraft

Boat-shaped rafts made of rubberised fabric have been designed by the Goodyear Tyre and Rubber Company of Akron, Ohio, for use as standard equipment on all machines of the United States Naval Air Corps operating on aircraft carriers, or for use for over-water flights.

These rafts, of which 225 have been made, are of three main types—one-man rafts for single-seater fighters, or "pursuit" machines as they are termed in the United States; two-man rafts for observation aeroplanes; and rafts capable of holding seven men, for use in transport machines. The most important equipment of each raft is a bottle of highly-compressed carbon dioxide gas, which instantly inflates the raft when a knob on the bottle is turned. The inflation tube or body of the raft is divided into two airtight compartments, each capable of supporting the occupants independently of the other. The rafts are packed in comparatively small cases, opened by pulling "zippers," and they occupy very little space in the aeroplane. When a machine is forced down on the water only a few seconds are necessary to remove the raft from its case and turn the knob on the gas bottle. The rafts are high in the water, and are easy to row by means of collapsible oars provided.

The "Jaguar"-Engined "Atalanta"

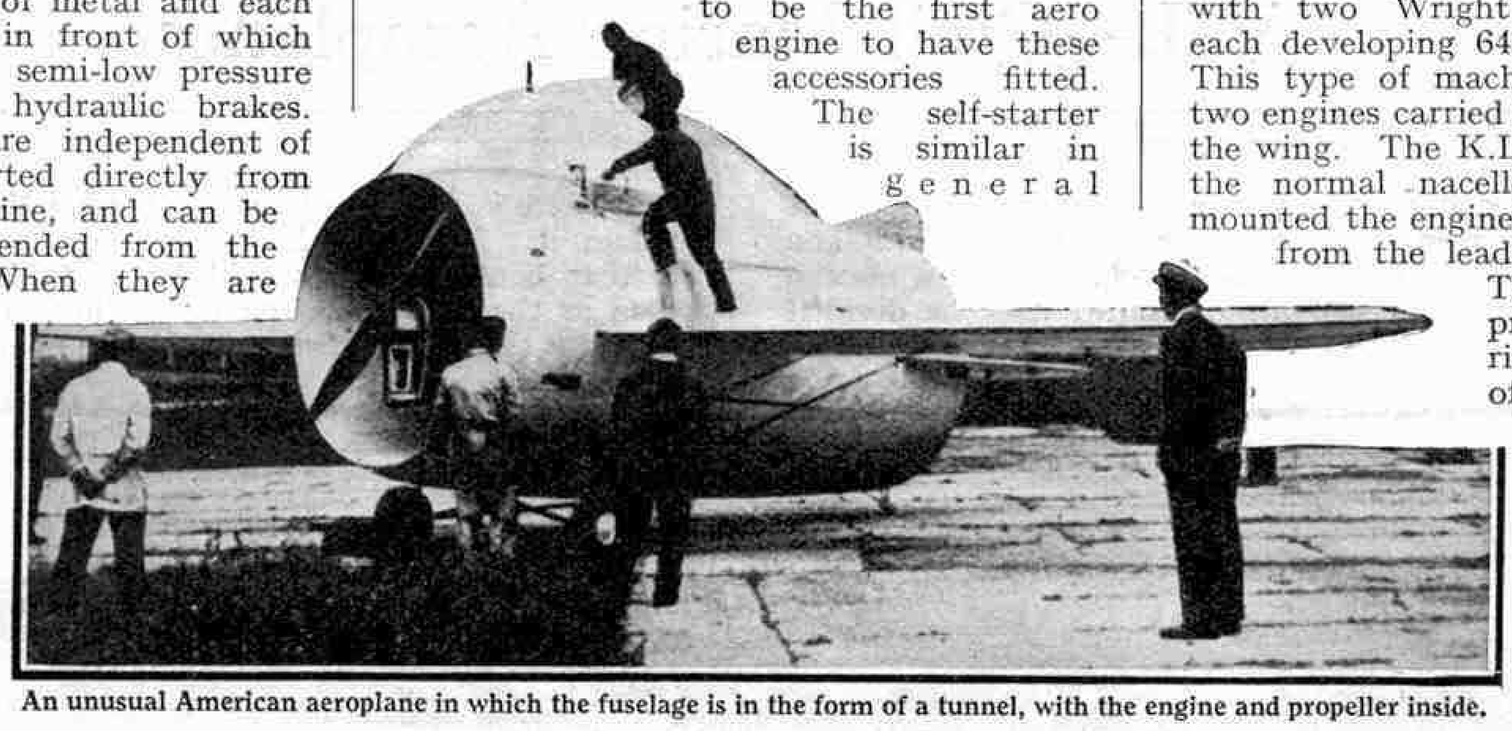
The Armstrong Whitworth "Atalanta" has been doing good work with Imperial Airways, but the performance of the type has now been greatly improved by the use of Armstrong Siddeley "Jaguar" engines developing 450 h.p., in place of the "Serval" so far used. With the new engines the "Atalanta" is capable of travelling at a maximum speed of 160 m.p.h. at sea level, and of cruising at 135 m.p.h., while the initial rate of climb is 1,000 ft. per minute and the absolute ceiling 19,000 ft. The aeroplane is capable of maintaining flight with any one engine out of commission, when it has a maximum speed at sea level of 120 m.p.h., a cruising speed of 108 m.p.h., and an absolute ceiling of 10,500 ft.

Novel Amphibian Gear

An unusual type of amphibian undercarriage has been designed and produced in the United States by the Seversky Aircraft Corporation of New York. The undercarriage is of the twin-float type, the floats being made of metal and each having a single step, in front of which is a slot that holds a semi-low pressure wheel equipped with hydraulic brakes. The wheels, which are independent of the floats, are supported directly from the wing of the machine, and can be retracted into or extended from the slots hydraulically. When they are retracted, the floats are automatically locked in position; while when the wheels are down the floats are free to move up and down slightly in the vertical plane, being pivoted at the front.

The floats are provided with small wheels that are built on to the water rudders at the ends. When a landing is being made on an aerodrome, these wheels touch ground first and push up the floats until the machine is running on the main wheels and the normal tail wheel under the empennage. This arrangement makes it unnecessary for exceptionally strong floats to be provided, as would be the case if the floats were not free.

This interesting undercarriage has been fitted on the Seversky Sev.-3 amphibian, a cantilever low wing all-metal monoplane that seats three and is equipped with a 420 h.p. Wright "Whirlwind" radial air-cooled engine. The machine is 36 ft. in span and 25 ft. 8 in. in length, and it has a maximum speed at sea level of 190 m.p.h. and a landing speed of 60 m.p.h.



An unusual American aeroplane in which the fuselage is in the form of a tunnel, with the engine and propeller inside.

The Terminal Velocity Dive

An important feature of the performance trials of modern fighting aircraft is the diving test, during which the machine is allowed to dive vertically until its terminal velocity, or the greatest speed it can possibly attain, is reached. Under these conditions the rate of revolutions of the engine may rise to 30 per cent. above the normal, increasing the dynamic loadings and stresses of vital components by as much as 70 per cent.

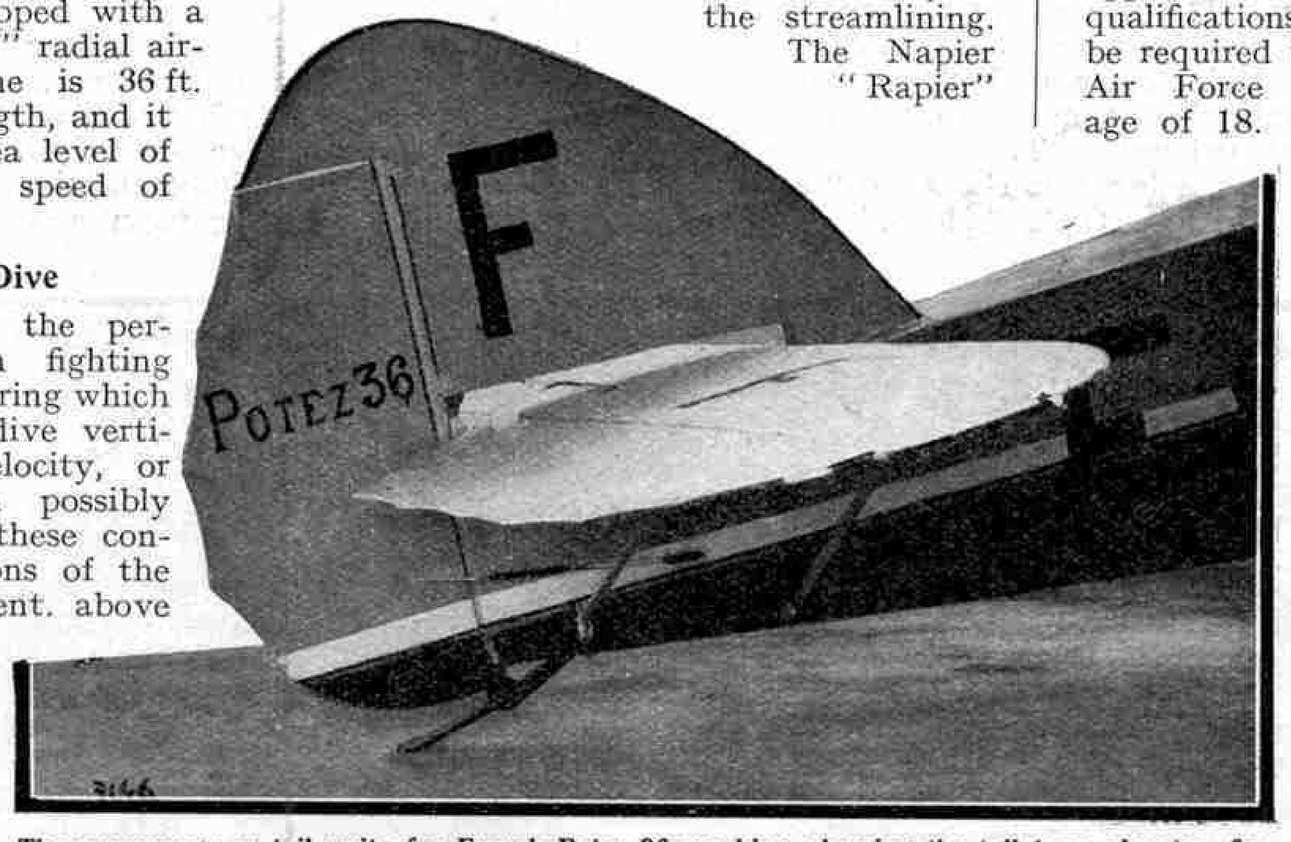
The Bristol Aeroplane Co. Ltd. have designed their latest fighter type engine, the "Mercury V-S2," to meet these conditions. As the present standard schedule of tests for type approval of aircraft engines does not cover these excess speeds, this engine on completion of its official type test was submitted to supplementary high speed tests during which it was made to run for one hour at 20 per cent. above normal speed, followed by 10 min. at 30 per cent. above normal speed. After the test the engine was stripped, and it was found that the special checks taken before and after the test did not reveal any appreciable detrimental effect of the high-speed running.

* * * *

A parachute suitable for use in commercial aeroplanes has been produced by the Irvin Air Chute Company Ltd.

Self-Starters and Dynamos for Napier Engines

A self-starter and a dynamo are now being supplied with the Napier "Javelin" six-cylinder-in-line air cooled engine. This engine develops 165 h.p., and is claimed to be the first aero engine to have these accessories fitted. The self-starter is similar in general design to those used on motor cars, and is operated from a 45 amp. hr. battery. It is 5½ lb. in weight and will make it possible to dispense with the dangerous task of swinging the propeller in order to start the machine. The dynamo, which weighs 29 lb. and is driven from the engine, will make it unnecessary for a generator driven by a fan to be placed outside the fuselage, thus detracting from the efficiency of the streamlining. The Napier "Rapier" air-cooled engine is also being provided with a somewhat similar self-starter and a dynamo.



The empennage or tail unit of a French Potez 36 machine, showing the tailplane, elevator, fin, and rudder. The F shows that the machine is registered in France.

Radio Set for Light Aeroplanes

A radio receiver for light aeroplanes, constructed by a British company, can be carried in a luggage locker or any other suitable part of the machine and worked by remote control from the pilot's cockpit. The container for the set and the batteries measures only 13 in. in length, 10 in. in width and 6 in. in depth, and is 20 lb. in weight. The set will receive and send messages and may be used to enable the occupants of open cockpits in the same machine to converse with each other. Communication in this way is much clearer than speaking through the voice pipes.

Experiment with Engine Nacelles

An interesting experiment in connection with the positions of engines in multi-engined aeroplanes has been carried out by the Royal Dutch Air Lines, or K.L.M., with a Fokker F.VIII machine equipped with two Wright "cyclone" engines, each developing 640 h.p. at 1,900 r.p.m. This type of machine is built with the two engines carried in nacelles slung below the wing. The K.L.M. engineers removed the normal nacelles and engines, and mounted the engines in nacelles projecting from the leading edge of the wing. The engines were also provided with Townend rings. As a result of these modifications an increase in speed of about 10 m.p.h. has been attained, bringing the maximum speed of the machine up to about 160.5 m.p.h. It is interesting to note that the engines are not close up to the wings, but are held by the nacelles some distance in front.

Vacancies in the R.A.F.

The Air Ministry announce that vacancies exist in the Royal Air Force for well-educated boys between the ages of 15½ and 17, in possession of an approved first school certificate, to enter as apprentice clerks this month and in January. Entry will be by selection from among applicants with the necessary educational qualifications. Successful candidates will be required to complete 12 years' regular Air Force service after reaching the age of 18. At the age of 30 they will normally return to civil life, but a limited number, subject to service requirements, may be permitted to re-engage to complete 24 years' service qualifying for pension. Detailed information regarding the scheme can be obtained from the Secretary, Air Ministry (Apprentice Clerks Department), Gwydyr House, Whitehall, London, S.W.1.

World's Distance Record

The world's record for distance flown in a straight line is held by two French airmen, M. Rossi and M. Codos. Taking off from New York, they flew to Rayak in French Syria, a total distance of about 5,657.6 miles. Their machine was a Blériot 110 monoplane with a 500 h.p. Hispano-Suiza engine.

The record was previously held by the British pilots, Sq. Ldr. O. R. Gayford and Flt. Lt. G. E. Nicholetts who, in February of this year, flew from Cranwell to Walvis Bay, in South Africa, a distance of about 5,306 miles. The flight was made in the Fairey Long Range Monoplane equipped with a Napier "Lion" engine.

New Short Passenger Machine

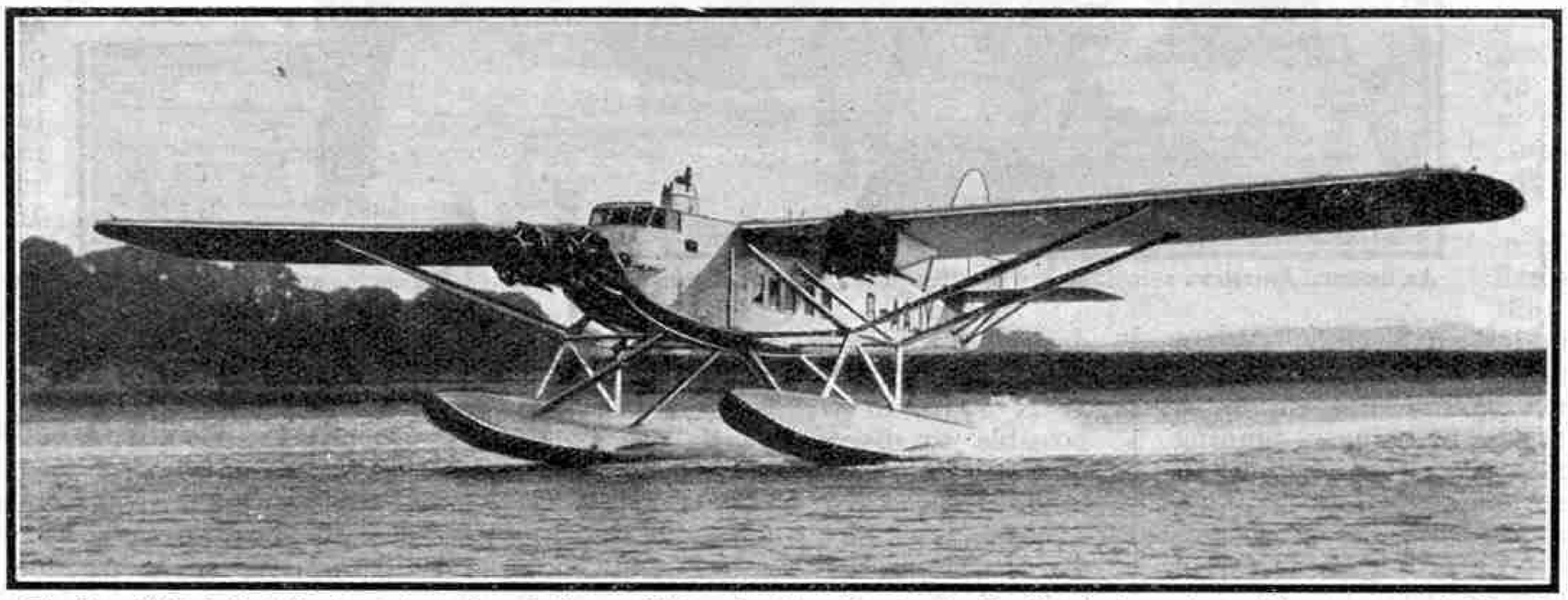
A new passenger machine has recently been constructed by Short Brothers (Rochester & Bedford) Ltd. It is a high wing cantilever monoplane and is equipped with two Pobjoy engines.

British Aircraft Developments

VII.—Civil Marine Aeroplanes

THE essential difference between a landplane and what may be termed a marine aeroplane is that a landplane can take off from and land on solid ground, while a marine machine operates from water. Marine aircraft may be divided into three categories—the float seaplane; the hull seaplane or flying boat, in which the fuselage has been turned into one big float; and the amphibian, which may be either of the float or hull type.

British marine aircraft designers have specialised mostly in the construction of large flying boats, and these are without doubt the finest craft of their type in the world. Many float seaplanes are built in this country, however, but most of them are merely adaptations of existing landplane types. For instance, the aeroplanes used by the Fleet Air Arm of the R.A.F. are usually built as landplanes, but they are designed so that without much trouble they can be equipped with float undercarriages. This is the case also with light aircraft, such famous machines as the Avro "Avian," the Blackburn "Bluebird," and the D.H. "Moth," all being available fitted with either floats or a wheel undercarriage.



The Short "Valetta," the largest seaplane in the world, taxying "on the step." For the photographs on this page we are indebted to Short Bros. (Rochester & Bedford) Ltd.

When a landplane is fitted with floats it becomes more difficult to fly. The speed drops slightly, and cross winds have more effect on the machine on account of the greater side area of the floats. These floats are usually made of duralumin, and are similar in design to a racing motor boat, being provided with a step or notch in the bottom of the hull. When the machine is taxying over the water the floats are partially submerged along their whole length, but as speed is gained they rise in front until they resemble a racing motor boat at high speed. This process is known as "getting on to the step," and it makes it possible for the nose of the aeroplane to be put up at a greater angle to the water, and thus lessens the distance required for taking off. The step also breaks up to some extent the large stern wave that normally follows behind the machine.

In taking off a seaplane the pilot taxies it out on to the water and throttles down the engine. The machine then automatically swings round and faces into the wind, on account of the fact that there is more keel surface behind the centre of gravity than before it. The throttle is then advanced, with the stick held further back than it would be in taking off a landplane. As soon as the pilot feels the tail trying to lift he pushes the stick into the central position, and the seaplane jumps up "on to the step" and hydroplanes over the surface of the water. When flying speed is reached the stick is pulled back fairly quickly, and the machine rises sharply out of the water. On a perfectly calm day, when the surface of the water is glass smooth, difficulty is often experienced in making the aeroplane "get on to the step." The usual procedure in these circumstances is for the pilot to taxi a certain distance in one direction and then turn round and endeavour to take off in the waves that he has already made.

A seaplane alights in a similar manner to a landplane but it is more difficult to judge correctly the height of the machine above the water than to judge height above an aerodrome. This is particularly so during calm weather when the water is glassy, and under these conditions the best method of landing is to "power stall" the aeroplane. When a landing is being made in this manner the engine is kept on and the seaplane made to fly as slowly as possible, and when stalling speed is nearly reached and the machine is close to the surface of the water, the stick is pulled right back, causing the aeroplane to stall and fall into the water.



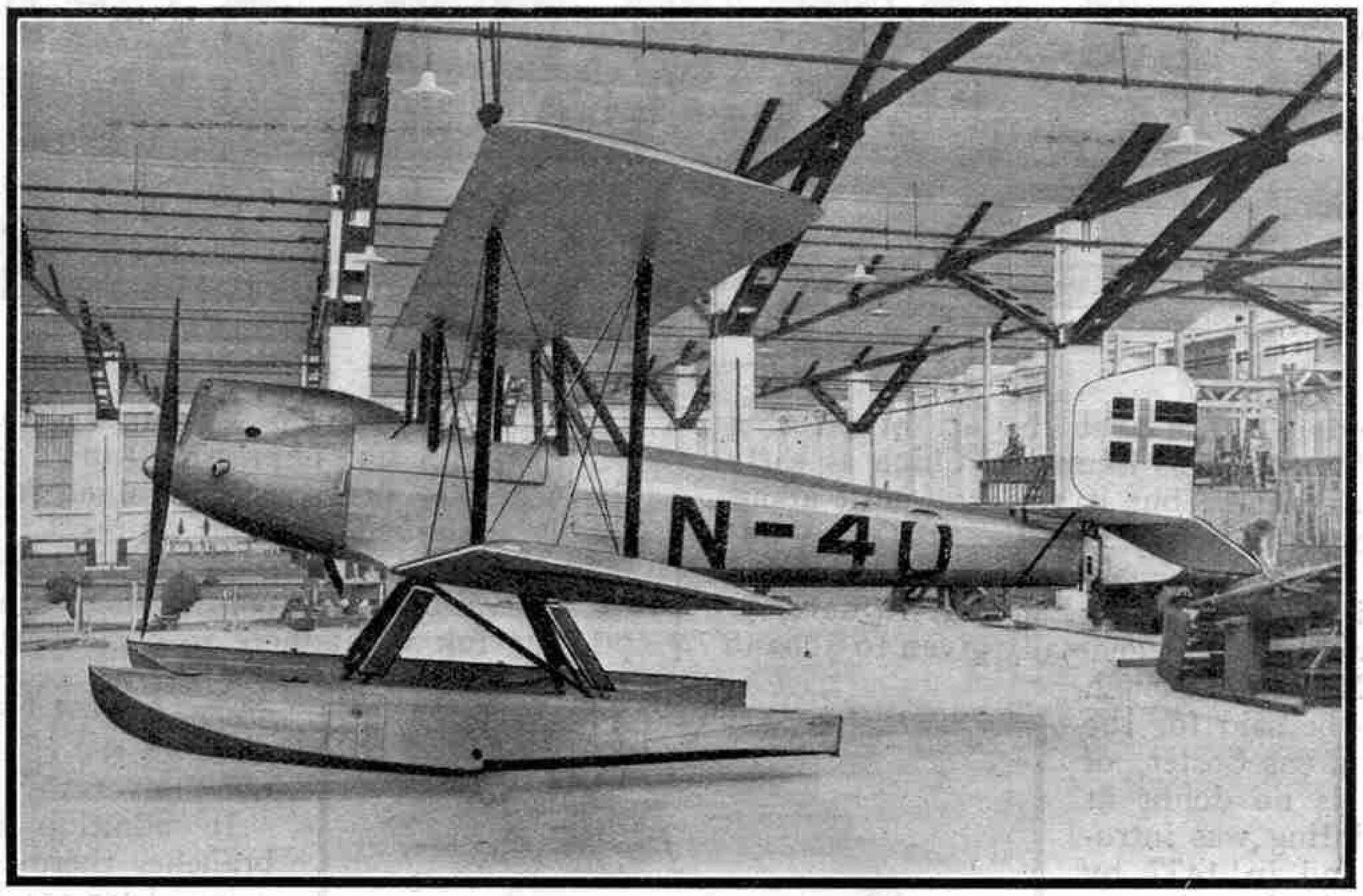
This photograph shows the Short "Mussel" single-float amphibian.

There are various "pointers" about the nature of the water on which a landing is to be made, for which seaplane pilots learn to look out. For instance, although it is best to land fairly close to the shore, all regions where there are reeds must be avoided as they will definitely be very shallow. Hidden rocks also must be watched for, and it is important that the pilot should realise that as soon as the seaplane has alighted on the water it becomes affected by tides and currents and needs careful manœuvring and navigating.

An article describing the leading British hull seaplanes or flying boats was published in our issue for May 1930, and in this article we intend to describe four well-known British float seaplanes, the Blackburn "Bluebird," the D.H. "Gipsy Moth," the Short

" Mussel," and the Short " Valetta." These are all civil seaplanes.

The Blackburn " Bluebird " is an all-metal machine designed and originally constructed by the Blackburn Aeroplane and Motor Co. Ltd. Owing to the large number of other machines built bv the firm, however, the actual production of the latest all-metal version is carried out by Saunders - Roe Ltd., of East Cowes, Isle of Wight. The machine is a two-seater light biplane, and the most interesting feature about it is that it has only one cockpit, the pilot and the passenger being accommodated in this side by side. The " Bluebird " was the first successful light aeroplane in which such accommodation was offered, and although the extra width of the fuselage causes the machine to be a little slower than if the occupants were seated in tandem, the aeroplane has an excellent performance and is very popular. This " sociable " method of accommodation makes the machine very suitable for training purposes, for the pupil actually sees how his instructor manipulates the controls, and when he himself is piloting the machine his movements can be closely watched and his mistakes corrected immediately.



A light biplane seaplane, the Blackburn " Bluebird." Photograph by courtesy of the Blackburn Aeroplane & Motor Co. Ltd.

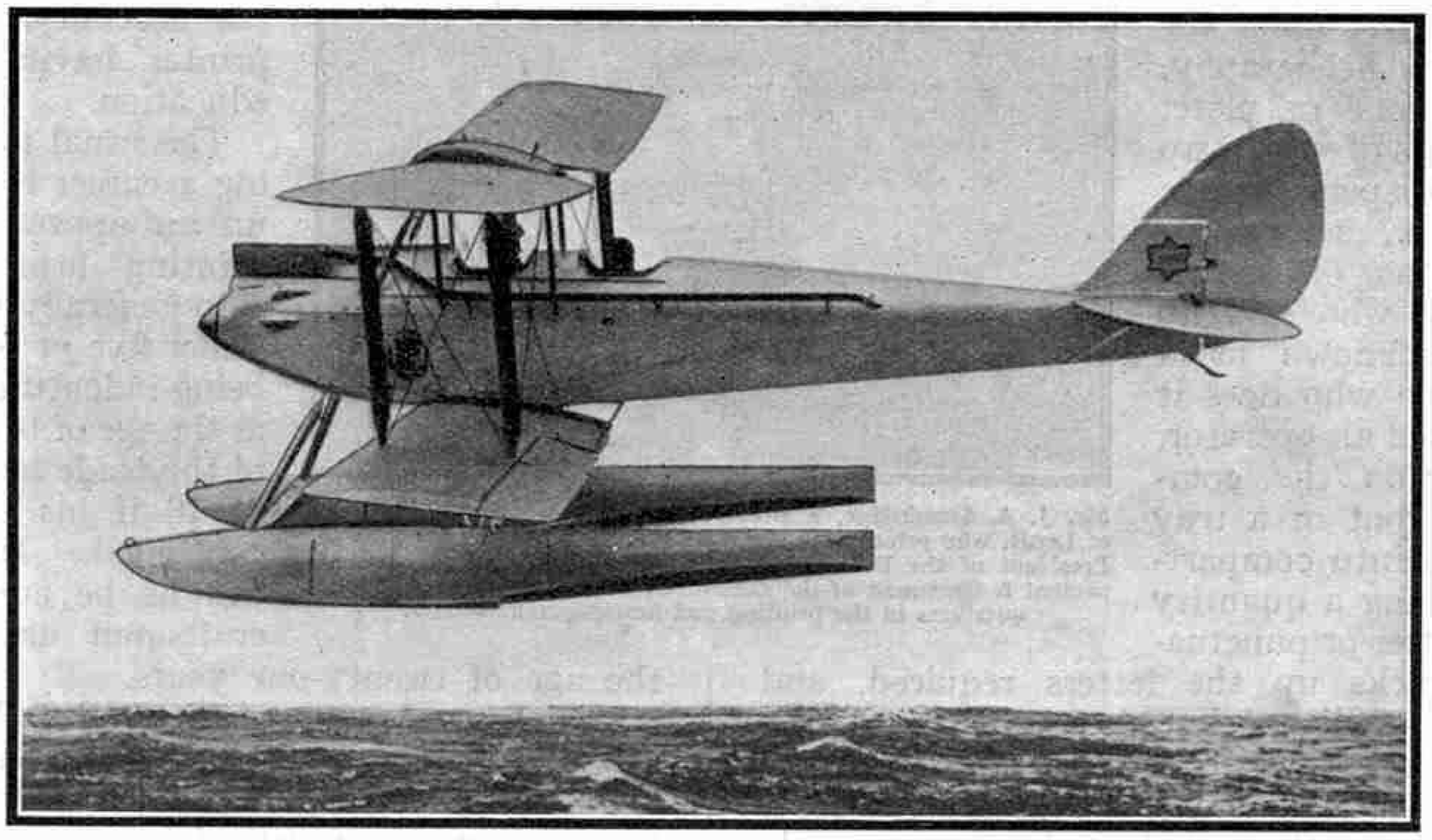
The wings of the " Bluebird," like those of most light aeroplanes, are designed so that they can be folded quickly and easily, and they then have a span of 9 ft. 10 in. The span when the wings are opened out is 30 ft. The fuselage is built up in a number of distinct units that can be rapidly and easily disconnected when necessary for repair or replacement. The central part consists of duralumin frames, and the four main steel tubular members are braced by tie rods. In front of it is the engine unit, and the foremost transverse member forms a fireproof bulkhead between it and the cockpit. The other duralumin frames form the attachments for the chassis, bottom planes, and top centre plane struts. Behind the central unit is a special four-longeron structure that is detachable at four points. This is attached to the empennage, which can be disconnected in one piece.

The land chassis normally fitted on the " Bluebird " is of the divided type, and it has a wide track in order to increase the stability of the machine when taxying over rough ground. The float chassis is of normal type, two duralumin floats being employed. They are joined to the fuselage by a triangulated system of steel struts, and there are no horizontal cross members between the floats. An important feature of both types of chassis is that no wire bracing is employed. This greatly simplifies the upkeep of the machine.

Normally the " Bluebird " is fitted with a " Gipsy " engine, and it then weighs about 1,040 lb. empty, and 1,750 lb. loaded. It has a maximum speed of 98 m.p.h., a cruising speed of 85 m.p.h., and lands at 45 m.p.h. Its initial rate of climb is 650 ft. per minute and the service ceiling 12,000 ft.

The D.H. " Gipsy Moth " seaplane is similar to the landplane versions that have been illustrated from time to time in these pages. As our readers are aware, the "Moth" is undoubtedly the most popular land aeroplane in the world, and has been used on many fine flights, particularly from England to the Cape and to Australia. The machine is a two-seater biplane. The wings are equal in span and measure 30 ft., and when required for garaging purposes they can be folded back to give an overall width of 9 ft. 10 in. They are of wood and metal construction. The machine can be obtained fitted with either a wooden or metal type fuselage, which in both cases is a rectangular structure. The land type undercarriage is of the split-axle type, but when fitted as a seaplane the Short all-metal floats are braced together by struts.

The " Moth " seaplane with a " Gipsy II " engine has an empty weight of 1,120 lb. and an all-up weight of 1,750 lb. It has a maximum speed of 101.5 m.p.h., a cruising speed, at 1,000 ft., of 86 m.p.h., a stalling speed of 46 m.p.h., and an initial rate of climb of 600 ft. per min. The absolute ceiling is 13,300 ft.



A D.H. " Moth " seaplane about to alight. Photograph courtesy the " Aeroplane."

The most interesting feature of the Short " Mussel " is the single float amphibian undercarriage which is the only one of its kind constructed in this country. It is made of duralumin, and is secured below the fuselage by thin tubular struts, all the fittings and wiring lugs for the cross bracing being of stainless steel in order to prevent corrosion. A small water rudder is fitted on the rear of the float, and this is connected to the rudder bar in order to assist in manœuvring the machine when it is taxying on the water. The bottom part of the rudder is used as a steering tail unit when the machine is on land. The landing wheels are carried on special rubber sprung legs mounted on an axle that rotates in bearings fitted inside the main float. The axle is provided with worm gear that can be operated from the pilot's seat through the shaft and universal joint, thus making it possible for the wheels to be raised or lowered when the machine is in the air.

The " Mussell " is an all-metal machine with wings and fuselage built on standard Short principles. *(Continued on page 763)*



XLVII.—A PRINTER

THERE is good evidence that the art of printing from movable type was known in China as early as the 13th century, but it was not until about the middle of the 15th century that the first press was set up in Europe. The art appears to have been invented in Europe quite independently of Far Eastern developments, and the credit for it is generally given to Johann Gutenberg, of Mainz, although there is much to be said for the rival claims of Laurens Coster, of Haarlem. There is no doubt at any rate that printing was introduced into England in 1477 by William Caxton, who issued more than 100 works from his press at Westminster.

The work of the printer may be divided into three main sections, each of which is really a distinct and separate trade. These sections are composing, or type-setting; machining, or printing from type or other relief or intaglio surfaces; and lithography, or printing from stone or plate.

Composing consists of setting up the type for newspapers, books, advertisements, etc., either by hand, or by means of special machines. A man who sets up type by hand is known as a compositor, and one who does it by machine is termed an operator. In hand composition the compositor stands in front of a tray or "case" divided into compartments each containing a quantity of one particular letter or punctuation mark. He picks up the letters required, and places them in an appliance known as a "composing stick" to form lines of words. Composing machines are of two classes, those that cast a solid line of type, known as a "slug," and those that produce a line made up of single letters, as in hand composition. On both classes of machines the operator manipulates a keyboard similar to that of a typewriter, the depressing of the keys setting in operation mechanism that ultimately produces lines of type spaced and ready for printing.

Machining, or printing from type or other relief surfaces, includes the control of a variety of machines, ranging from those used by small jobbing printers to the enormous presses used for printing daily newspapers. There are many types of machines, but they may be divided roughly into two main classes, "platens," which give a flat impression, and "cylinders," where the necessary pressure is obtained from what may be simply described as large drums.

Lithography is a process of printing from flat surfaces that have been treated in such a manner that the printing ink will adhere to some parts of the surface, but not to others. Metal plates are now used very extensively in place of the stone that originally was universally employed.



Mr. J. A. Stembridge, a director of John Waddington Limited, of Leeds, who print the "Meccano Magazine." In 1927 he was President of the British Federation of Master Printers, and at present is Chairman of the Committee that deals with all labour questions in the printing and newspaper industries.

In addition to the foregoing branches there is also a constant demand for creative artists in the printing industry, and a boy who shows signs of having definite artistic ability is generally welcomed by progressive firms.

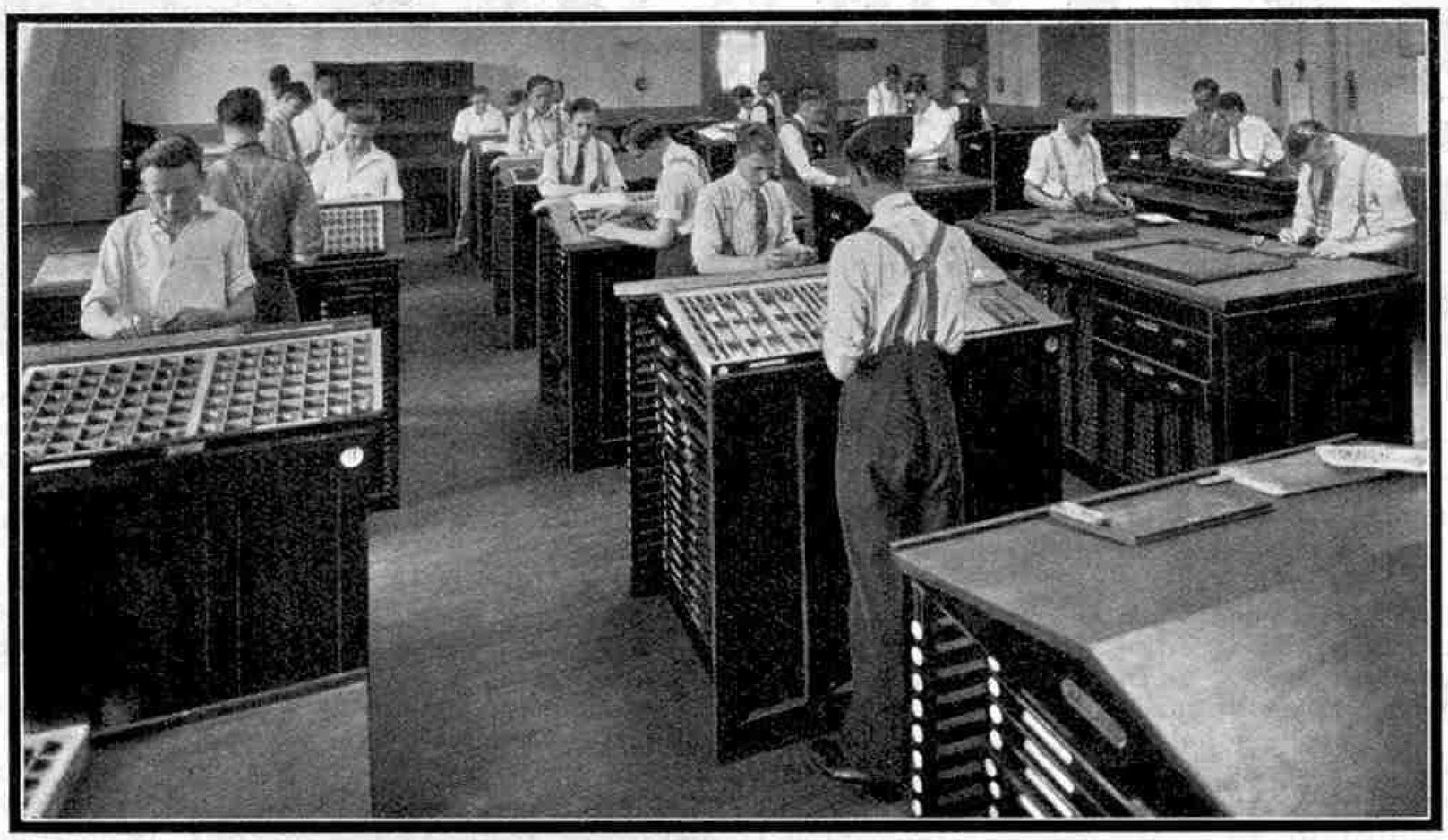
The educational requirements necessary for printers are above the average, and too great emphasis cannot be placed upon the necessity for the prospective printer having a sound general education.

The usual method of commencing a career in printing is to take up an apprenticeship with some printing firm. This apprenticeship generally lasts for a period of either five or seven years, the boy being indentured on leaving school at the age of 14. In some branches of the trade he may be indentured at 16 if his education has been continued. In no case, however, will he be admitted as a skilled craftsman until he has reached the age of twenty-one years.

Whichever branch of the trade a boy decides to take up he will be required to supplement the workshop training that he receives by theoretical and practical training at some school where suitable courses are available. In some towns there are night schools for this purpose, and in others boys are granted a certain number of hours off every week to attend day classes. At these classes a boy will be trained for examinations held by the City and Guilds of London Institute, or the Stationers' Company and Printing Industry Technical Board. The examinations in typography held by the City and Guilds of London Institute are divided into two sections, the first dealing with the work of the compositor and the second with press and machine

work. There are three examinations for each section, graduated in difficulty.

Boys who take up lithographic work in a printing firm are also catered for by the City and Guilds of London Institute. Those who sit for the examinations are expected to follow a course of instruction extending over at least three years, and an examination is arranged for the end of each year.

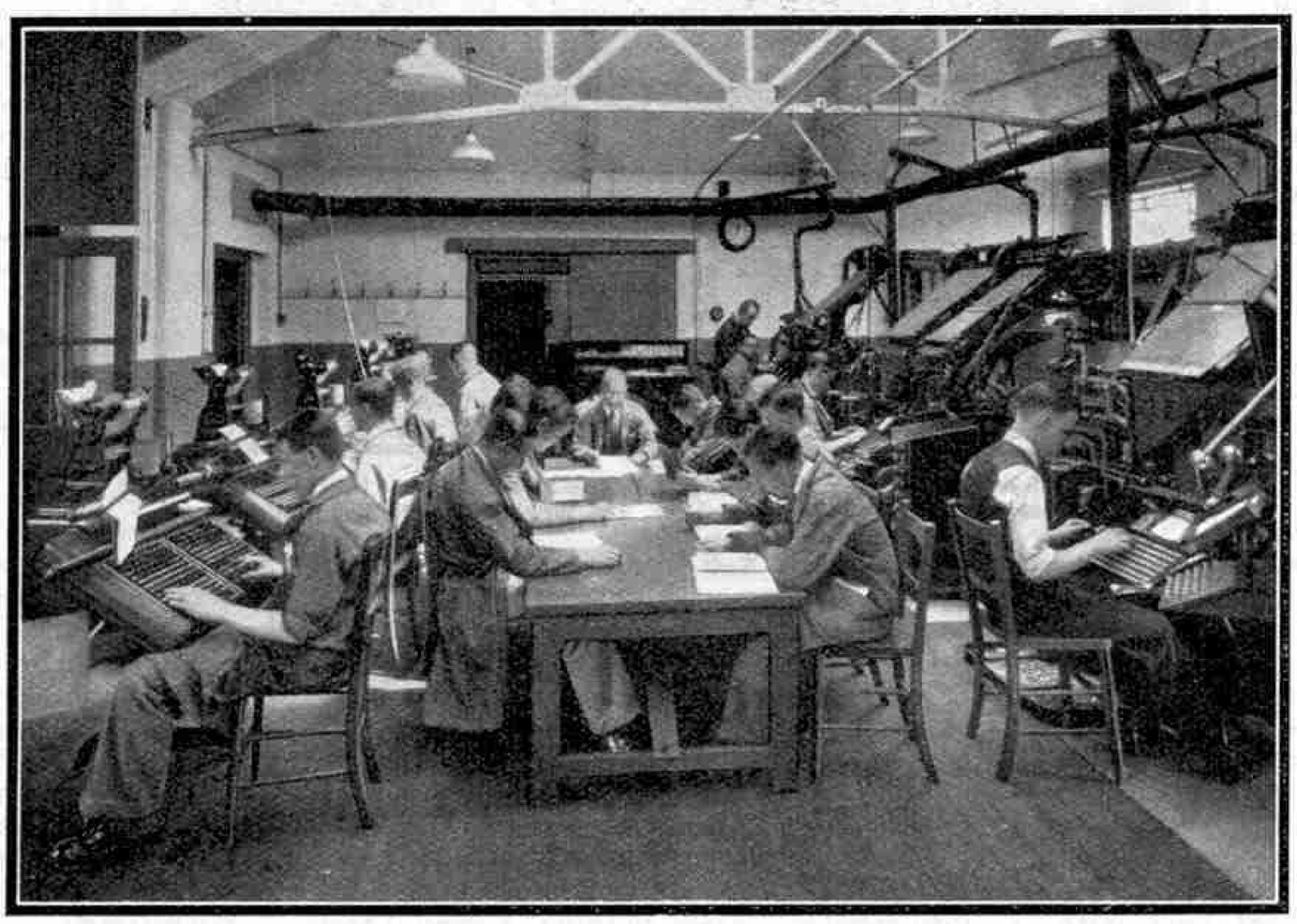


Hand compositors at work in the London School of Printing and Kindred Trades. The compositors are standing in front of "cases" where they make up the line of type in composing sticks.

It should be noted that the City and Guilds of London Institute is purely an examining body, and that it does not organise courses or classes. The object of the Institute is to provide annual examinations of a uniform standard for candidates in Great Britain and Ireland, and the Overseas Dominions of the Empire. Training courses for the examination of this body, and various others, are held in many evening institutes, and technical and art schools throughout the country. Information about suitable courses can be obtained from the secretary of the local Education Committee.

Printing apprentices in London are able to obtain their training at the London School of Printing and Kindred Trades, the largest school of its kind in the world. For more than 28 years it was known as the St. Bride Printing School. At first classes were held only in the evenings, but in 1917 a number of employers agreed to send their apprentices to the school during working hours, and to pay their wages and fees while in attendance. This is now the general custom with all printing firms in London. The number of students grew to such an extent that eventually the London County Council took up the matter, and the school was transferred to new premises and given its present name. The school curriculum covers all branches of the printing industry, and provides for both theoretical and practical training. Students of the school are prepared for the school's own examinations, and those conducted by the Stationers' Company and Printing Industry Technical Board. A copy of the prospectus and full information in regard to courses may be obtained from the Principal, the London School of Printing and Kindred Trades, 61, Stamford Street, Blackfriars, London, S.E.1.

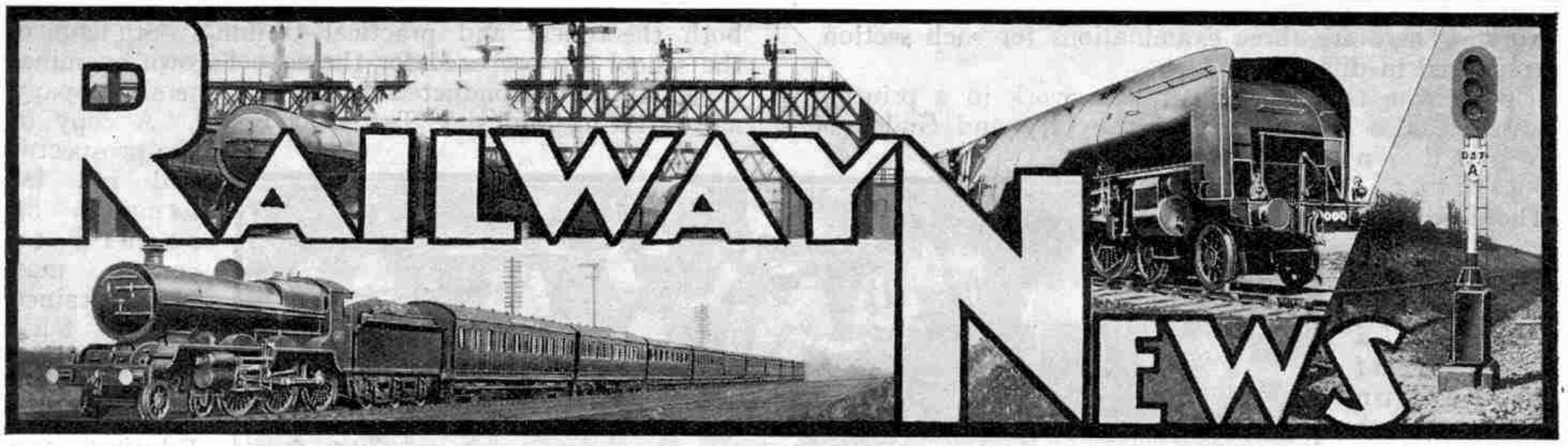
A typical example of the range of classes for the printing trades available in the provinces is provided by the Liverpool City School of Art. The classes are nearly all held in the evenings, in order that full advantage may be taken of them by all engaged in the trade. The session lasts about 32 weeks, and all students who are under 21 years of age are required to attend examinations held by the school at the close of the session. Older students may attend these examinations if they wish, and advanced students are prepared for the examinations of the City and Guilds of London Institute. The workshops are fitted with all the necessary appliances, tools and up-to-date machinery, and in nearly all cases materials are provided free.



A group of monotype and linotype students learning the art of mechanical composition on part of the very extensive printing plant that has been installed at the school. For permission to reproduce the interesting photographs on this page we are indebted to J. R. Riddell, Esq., Principal to the London School of Printing and Kindred Trades.

In addition to printing proper, the commercial side of the business provides good opportunities for intelligent lads of good education. Besides the usual commercial clerical work there is specialised work, such as that of salesman, and order, costing and estimating clerks. Appointments to these posts are often made from the clerical staff, but, on the other hand, many firms prefer to give such positions to those who have had a practical technical experience.

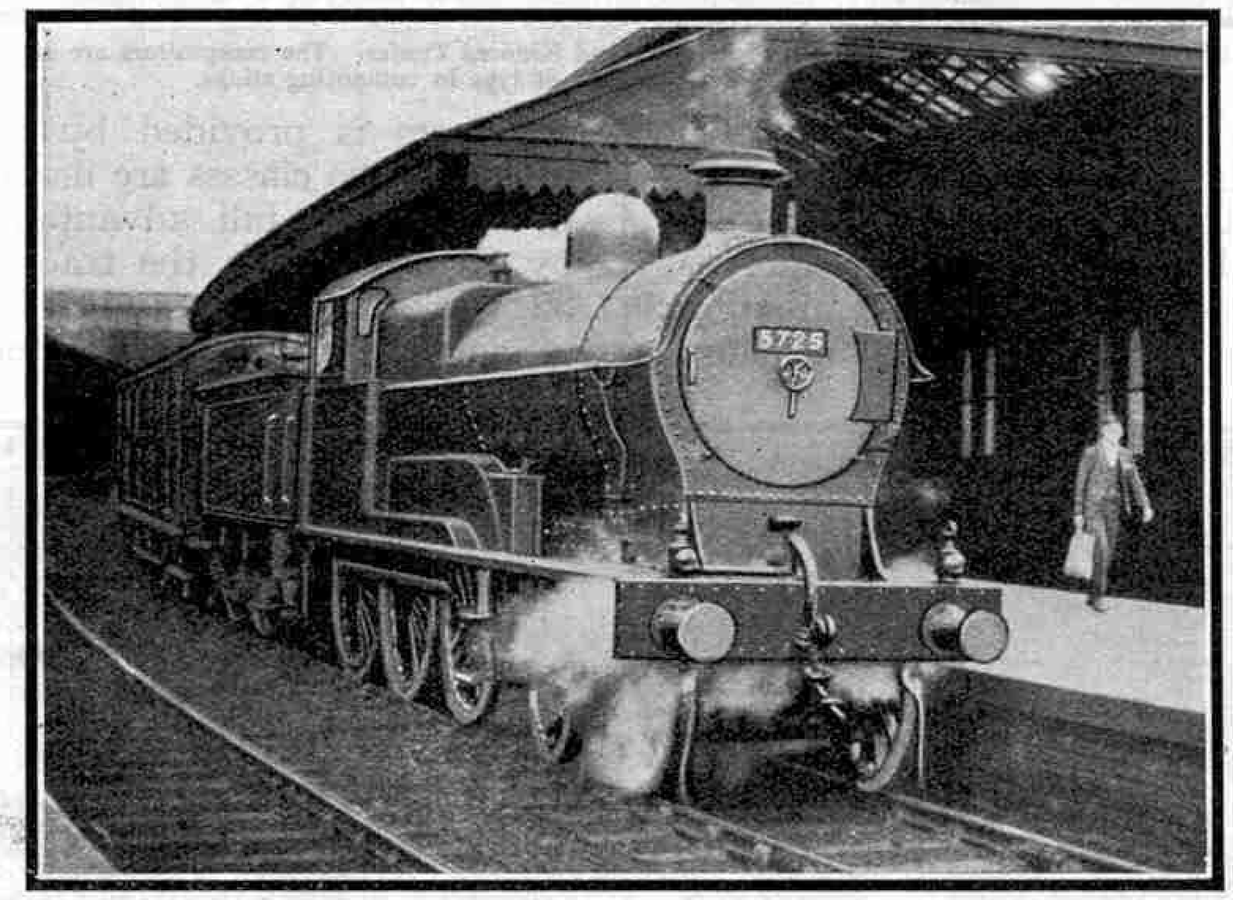
The printing craft offers excellent opportunities to intelligent boys of good education, willing to begin at the bottom and rise by merit alone.



British Railways' Successful Season

The past summer season brought a notable and welcome increase of passenger traffic to the railways of Great Britain. The outstanding causes of this were, no doubt, the wonderfully favourable weather that prevailed almost throughout the summer, and the attractive new facilities offered by the railway companies. In particular the "summer tickets" made a strong appeal to the travelling public. By these, at the charge of a penny a mile for the return journey, passengers were permitted to travel by any train on any day, the return being made on any day within a month of the date of issue. So popular were these tickets that during August, and especially at the week-ends, the railways were almost overwhelmed by the vast numbers of passengers and enormous weight of luggage that had to be dealt with. Some of the most favoured trains frequently loaded up to 16, 17 or even 18 coaches, and on the busiest days had to be run in several parts. It was not surprising that some delays occurred and trains sometimes arrived at their destinations much behind their schedules. Yet on other occasions the punctuality observed by even the fastest expresses was most praiseworthy.

The success of the "summer tickets" has encouraged the railway companies to continue the facilities until the end of the year, and there seems a fair hope that they may be made permanent. In addition to the increase in passenger traffic, freight returns have also shown improvement in recent months and there is reason to believe that the long-continued decline has now stopped and a new period of prosperity set in for the railways.



L.M.S.R. 4-6-0 No. 5725 at Edge Hill, Liverpool. This locomotive is of the "Prince of Wales" class originally introduced in 1911, and now numbering 246 engines.

"*The Princess Royal's*" Test Trip

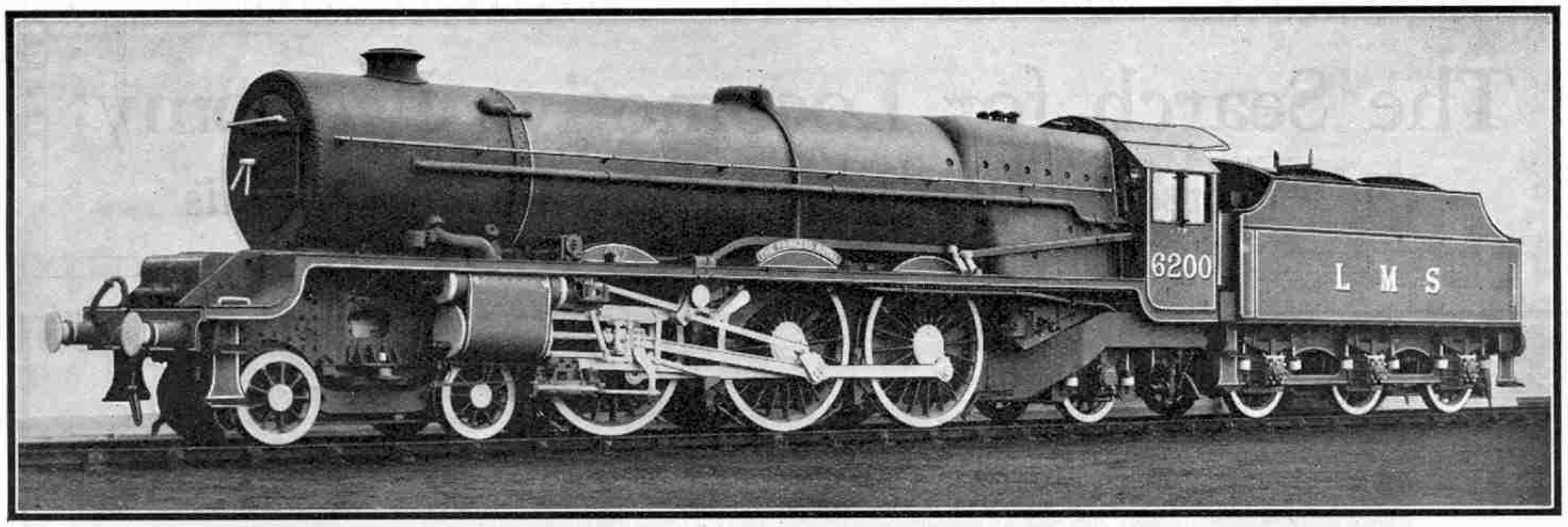
Crewe works are at present busy with an order for 40 2–6–0 "Mogul" mixed-traffic locomotives. Although in size and power they correspond closely with the previous standard "Moguls" of the L.M.S.R., Mr. Stanier has introduced many alterations in the details of the design. The boiler has top feed and its barrel is tapered; the working pressure has been increased to 225 lb. per sq. in. The cylinders, which formerly were inclined, are horizontal in the new engines, and while their diameter has been reduced to 18 in., their stroke has been increased to 28 in. The earliest engines of the series are just being put into traffic. They have a decidedly more attractive appearance than the original "Moguls" which, although efficient, were anything but handsome, and because of their ungainliness, were nicknamed "Crabs."

When the order for the new "Moguls" has been completed, a further 15 express engines of the 4–6–0 "Baby Scot" class will be proceeded with. The last engine of the previous batch of "Baby Scots" was No. 5903, "*Duke of Sutherland.*" It is intended to reconstruct some of the old L.N.W.R. 4–6–0 engines of the "Prince of Wales" class with two outside cylinders, so making them somewhat similar to the "Hall" class on the G.W.R.

The erection of the second "Pacific" locomotive has been so well advanced that it may be out of the works by the time this number of the "*M.M.*" is issued. Work on the third is being carried forward only slowly. Before the first "Pacific" No. 6200, "*The Princess Royal,*" was put into regular express running, a special test trip was arranged to which representatives of the press—including "Observer" of the "*M.M.*"—were invited. The train for the occasion was made up of 14 coaches, including the dynamometer car, and weighed (empty) 500 tons. The schedule required "*The Princess Royal*" to take this load from Euston to Crewe, 158.1 miles in 165 min., or, at an average speed of 57.4 m.p.h. start to stop. The start from Euston was masterly. Unaided by any bank engine and without any slipping, No. 6200 swung away briskly and then accelerated steadily up the bank that rises at 1 in 70 to Camden. The first mile, mostly on this stiff ascent, was covered in just a few seconds over three minutes—probably a record time for an unassisted engine with such a load. Primrose Hill tunnel was entered at 40 m.p.h.; Kilburn (3 miles) was passed in precisely 6 min; and Willesden (5.4 miles) was reached in 8 min. 40 sec., by which time the speed was almost 60 m.p.h. Up the long ascent to Tring speed was well maintained in spite of some rain and a strong side wind, and the summit was passed 50 sec. early. Down the slopes beyond—between Cheddington and Leighton Buzzard—a maximum of 76 m.p.h. was touched. Rugby, 82.6 miles from Euston, was passed at reduced speed, in 84 min. 10 sec., almost 2 min. ahead of schedule. By a stroke of misfortune, however, this splendid running could not be continued to the journey's end at Crewe. Just beyond Lichfield an axle box—the left one on the leading coupled axle—ran hot and, in consequence; the mighty engine and its train had to be brought to a standstill at Elmhurst siding, having covered the 118.8 miles from Euston in 122 min. 40 sec. After standing for several minutes, a fresh start was made and No. 6200 took the train through to Crewe but at reduced speed.

It was disappointing that the hot box should develop and mar the trip, but the fine "Pacific" had already displayed its powers and paces. At no point was there any forcing. There was always power in reserve. The running was easy and it was noticeable that even when the exhaust was softest the steam always went up well clear of the cab.

Later in the day the special train, reduced to a load of 215 tons, was brought back to London by "Royal Scot" locomotive No. 6151, "*The Royal Horse Guardsman.*" A special schedule was improved upon and in spite of two signal checks and a stop the journey was completed in 147¼ min. at an average of 64.2 m.p.h. From Crewe to the stop at Euston No. 4 box, the average speed was 66 m.p.h.; while from Nuneaton to the stop, the average speed for the 96½ miles was 71.2 m.p.h. Over long stretches a speed of over 75 m.p.h. was maintained and between Boxmoor and King's Langley a maximum of 85 m.p.h. was sustained for several miles. The enginemen in both directions were Driver A. Parsons and Fireman H. Betley.



S.R. Cross-Channel Train Ferries

The S.R. never ceases endeavours to improve communications between England and the Continent of Europe. Various works are now in hand in preparation for the train ferry service between Dover and Dunkirk which is to be put into operation in September of next year. All the train ferries at present working have been carefully inspected by engineers of the S.R. and it is intended to adopt the best possible methods for the new ferry. It is estimated that the necessary works at Dover will cost about £1,000,000 and that those at Dunkirk will cost a like amount. Both ports are to be made able to load or unload trucks at all states of the tide.

Three special train ferry vessels have been ordered and are to be delivered by next summer. Each vessel will be capable of taking a complete train of loaded goods wagons, which will not only have the advantage of saving the time now occupied in loading and discharging cargo boats, but will ensure the goods being conveyed in much better condition owing to the fact that they will not need to be handled en route.

In addition, however, to conveying merchandise, the ferries will be so constructed as to be capable of taking a full train of sleeping coaches, so that passengers will be able to perform the journey between London and Paris, or more distant Continental cities, in through coaches, thus ensuring a maximum degree of comfort.

The new vessels, which will be about 360 ft. long by 63 ft. beam, will have a speed of 16½ knots. They will be driven by single reduction Parsons turbines, which will be supplied with steam by Yarrow boilers burning coal.

Continental Mile-a-Minute Expresses

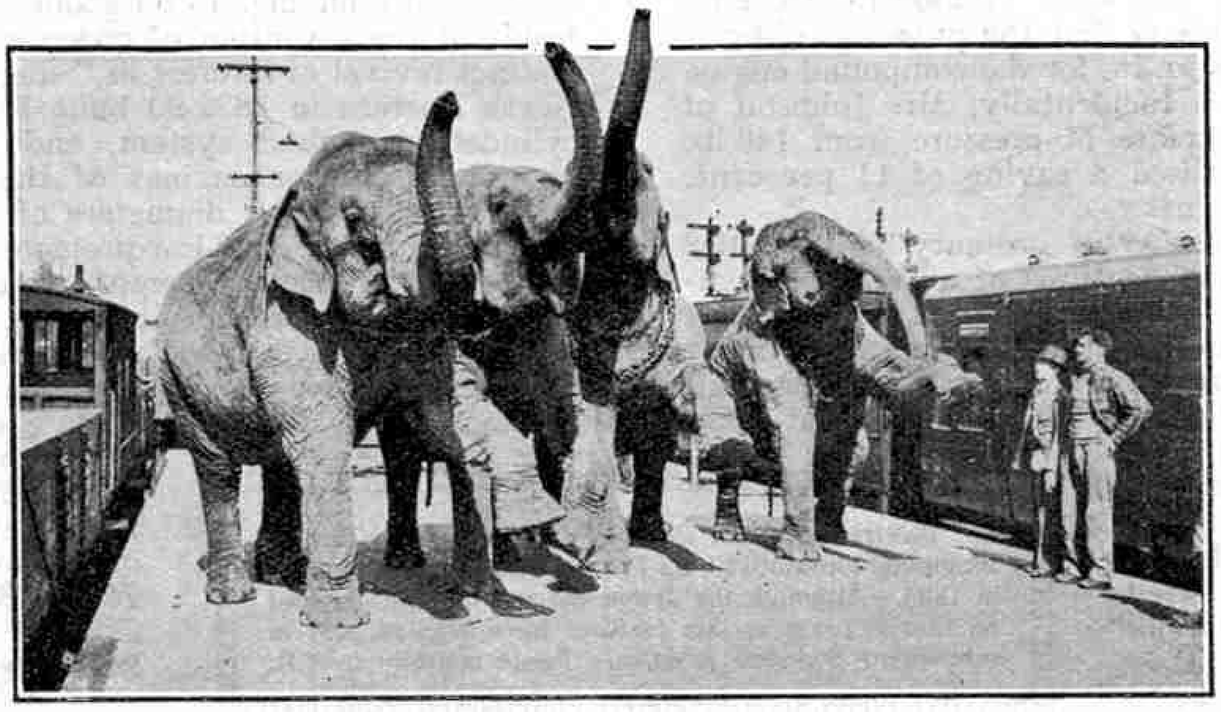
The "Railway News" in the August issue of the "*M.M.*" included a table showing the number of expresses in Great Britain scheduled to run at average speeds of 60 m.p.h. or more, start to stop. The total of 23 marked an advance on any previous year. It must be said, however, that during the past summer, train speeds on the Continent of Europe have shown a decidedly greater advance, and in France the number of expresses timed at speeds of over a mile-a-minute was very considerably increased.

The Northern Railway of France alone had 32 runs at 60 m.p.h. or over; the Paris-Orleans came next with 10; then the Alsace and Lorraine and the Est with five each; and finally the Etat with four, two of these being the runs of the Bugatti rail car between Paris and Deauville, timed to do the journey of 136.2 miles, in each direction, in the even two hours, giving an average of 68.1 m.p.h.

The fastest steam-operated train was on the Alsace and Lorraine line, covering the 67.3 miles between Mulhouse and Strasbourg in 61 min., at an average of 66.2 m.p.h. The Northern came next with two runs—one in each direction—between Paris and Jeumont on the Franco-Belgian frontier—a distance of 147.7 miles—at an average of 66.1 m.p.h. These trains reduce speed to cross the frontier but do not actually stop. Of start-to-stop runs the Northern had three at over 64 m.p.h.

In Germany, the State Railways claimed four runs at well over a mile a minute. Fastest of all were the trips of the "*Flying Hamburger*" rail car, which "flew" from Berlin to Hamburg at 77.4 m.p.h. (178.1 miles in 138 min.) and returned at 76.3 m.p.h. Steam-operated trains made the same journeys at 65.8 m.p.h. and 64.8 m.p.h. respectively.

In other Continental countries there have been marked improvements, but as yet no bookings at 60 m.p.h.



At the head of the page is a photograph, reproduced by courtesy of the L.M.S.R., of the new "Pacific" locomotive No. 6200, "The Princess Royal." Below, the elephants of Bertram Mills' Circus are seen in a special pose on the completion of a train journey to Guildford. Photograph by courtesy of the S.R. Magazine.

L.N.E.R. Locomotive News

Two further 3-cylinder 4–4–0 express locomotives of the D49, or "Hunt," class have been turned out from the works at Darlington and are now in service. They are numbered 288 and 292, and named "*The Percy*" and "*The Southwold*" respectively.

Three more 4–6–0 engines of the B12 class—Nos. 8571, 8573 and 8574—have been rebuilt with large boilers.

"Pacific" locomotives are now working regularly over the main line between Doncaster, Wakefield and Leeds (Central), the previous restriction which forbade their working over this section having been recently withdrawn.

Rebuilding L.M.S.R. Bridges

With the reconstruction of four bridges for which plans are now being prepared, the L.M.S.R. will have completed an intensive programme of strengthening bridges in various parts of their system in order to enable more extensive use to be made of the heavier and more powerful locomotives now in service.

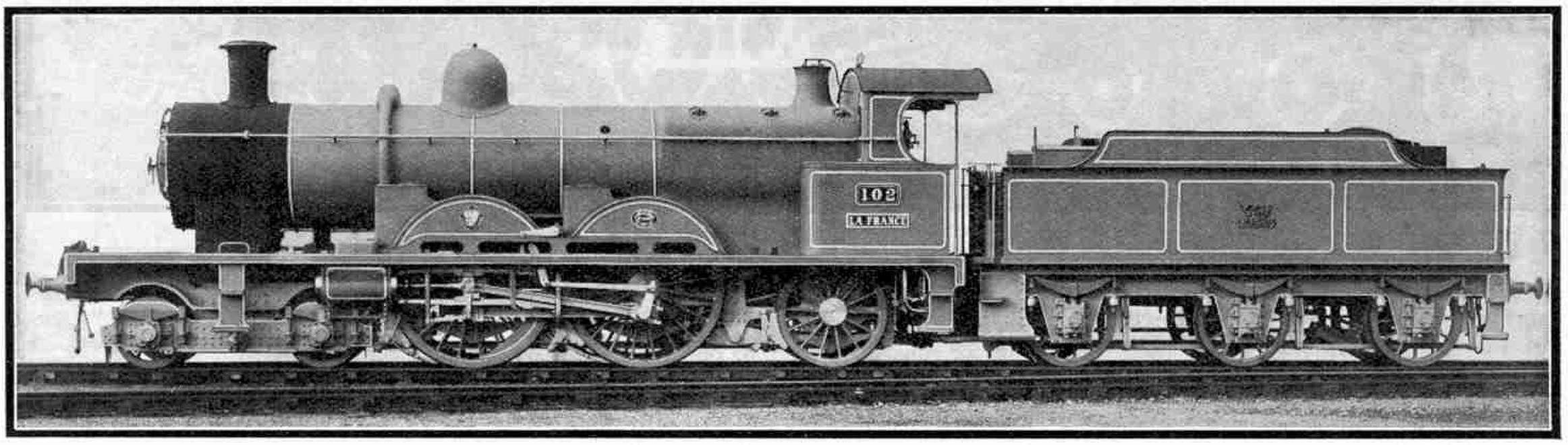
Under this scheme, which was begun in 1929, some 44 bridges have already been rebuilt and the four now in hand represent the last item in the programme. The routes to which this scheme has been applied are between Pye Bridge (on the Trent and Chesterfield Line) and Leeds; and between Clay Cross, south of Chesterfield, and Wichnor (between Derby and Birmingham) on the Midland Line.

Stream-lined Diesel-electric Railbus

The first stream-lined railway unit to be produced in Great Britain is an Armstrong-Whitworth Diesel-electric railbus that has recently undergone very successful tests in the North of England and in the neighbourhood of London. It is driven by a 95 h.p. heavy oil engine with electric transmission and can attain a maximum speed of 70 m.p.h. It weighs only 17½ tons, but can carry 60 passengers at a fuel cost of about a halfpenny a mile. When travelling up from Newcastle-on-Tyne to London, the total fuel cost for the 268 miles was 13s. 2d. and the little railbus took only 53 minutes more than "*The Flying Scotsman.*"

The Search for Locomotive Economy

III.—Worsdell, De Glehn and Smith Compounds



The illustration above shows the famous "De Glehn" compound locomotive "La France" built for the G.W.R. in 1903. Although the design did not become standard on that railway, certain features have been adopted in subsequent Swindon practice. Photo courtesy G.W.R.

A COMPOUND system that was applied to several engines on the Great Eastern and later the North Eastern railways was the two-cylinder arrangement preferred by Mr. T. W. Worsdell. His aim in adopting the compound system was to improve the thermal efficiency of the locomotive and so to economise in fuel, but at the same time he desired to retain the simplicity in design of the ordinary two-cylinder engine. A saving of 14½ per cent. in coal was claimed by him over 12 months' working for compound engines against simples; but the pressures differed between the two, being 160 lb. per sq. in. for the compound engine as against 140 lb. of the simple. Incidentally, Mr. Johnson of the Midland Railway, by the increase of pressure from 140 lb. to 160 lb. figure had already realised a saving of 11 per cent. in fuel with ordinary simple engines.

As compared with the construction of ordinary two-cylinder simple locomotives, the only special features of a Worsdell compound were the large low-pressure cylinder and the starting valve. The latter admitted live steam direct to the low-pressure cylinder for starting purposes. These engines were much simpler, and therefore cheaper to construct, than the Webb types; but there was necessarily a limit to the dimensions of the cylinders, either inside or outside the frames, and also therefore to the power that could be developed. For their time, when medium-sized engines sufficed, these two-cylinder compounds did good work, but they were speedily converted and replaced by larger simple engines as loads increased and higher speeds were demanded by the timetables.

The Great Eastern compounds were 4–4–0s with inside cylinders and their performances were somewhat variable. Mr. J. Holden, who succeeded Worsdell at Stratford, stated that, working at 160 lb. pressure, they showed an economy of 14 per cent. in fuel when compared with corresponding simple engines, but at the reduced pressure of 150 lb. the saving was 2 per cent. only.

The relative saving of fuel of individual compound systems is somewhat difficult to compare owing to the differences in the working conditions on the different lines. The Webb engines mentioned last month were not particularly remarkable as coal savers, but it must be remembered that, latterly at any rate, the work they were expected to perform was of an increasingly heavy character. In 1889 Webb quoted the consumption per mile of the "Experiments" as 26 lb., and that of the larger "Dreadnoughts" as 29 lb. to 30 lb. A tank locomotive that was converted from simple to compound working enabled some comparison to be made, though the pressures were different in each case. As a compound with a boiler pressure of 150 lb. per sq. in. it consumed 23.2 lb. of coal per mile, whereas working non-compound at 130 lb. boiler pressure the fuel consumption had been 31 lb. per mile. Whether the compound system or the increased pressure deserved the more credit for the improved figures is a moot point. The run from Euston to Carlisle made by one of the "Dreadnoughts" in 1885 involved the consumption of 29.2 lb. of coal per mile.

On moving from Stratford to Gateshead, Worsdell built a single 2–4–0 compound express engine. In several respects it resembled his previous Great Eastern practice, but there were two important differences—the working pressure was higher, and the Joy's valve gear had a differential arrangement in order to give varying cut-offs in the high-pressure and low-pressure cylinders. The next compounds were of the 4–4–0 type, and then followed some six-coupled tender and tank engines for goods traffic. About that time, as the result of the invention of power sanding apparatus, there was a distinct revival of interest in "single-wheeler" locomotives. The North Eastern in 1889-90 built 10 bogie "singles" on the two-cylinder compound system, and then followed them up with another 10 bigger engines of the same type. The latter had large cylinders with diameters of 20 and 28 in. respectively for the high-pressure and low-pressure units.

The North Eastern compound engines undoubtedly did some good work and were certainly more reliable than the contemporary Webb locomotives. One of the earlier 4–4–0s made the fastest time between Newcastle and Edinburgh in the 1888 "Race to Scotland," the 124½ miles being covered at the smart pace of 57¼ m.p.h. One of the large 4–2–2s in a special trial took a train of 270 tons from Newcastle to Berwick, a distance of 67 miles in 78 minutes. Speeds of 75 and 86 m.p.h. were reached and the average consumption of coal was 26.4 lb. per mile. Good results were also obtained with two-cylinder compound locomotives on the former Belfast and Northern Counties Railway, where the system was introduced in 1890. They were the first compounds in that country.

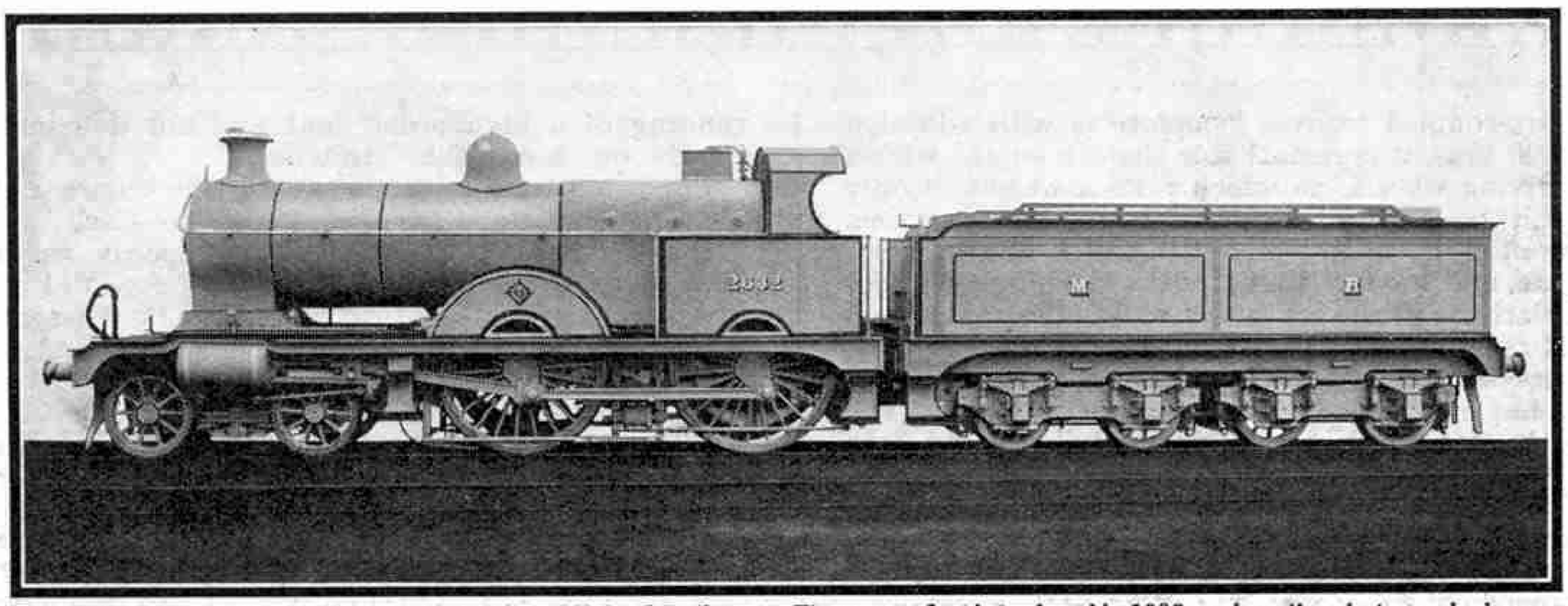
North Eastern locomotive policy continued the building of compounds until 1892, when the first of 20 new simple engines of the 4–4–0 type was turned out. At the same time an odd engine constructed as a two-cylinder compound enabled a direct comparison of efficiency to be made. Apparently the results did not favour the compound system, so in 1898 this engine, No. 1619, attained the practically unique distinction of being converted to a totally different system of compound working. This was the "Smith" three-cylinder system as devised by Mr. W. M. Smith of the North Eastern Locomotive Department, and applied to No. 1619 by his chief, Mr. W. Worsdell, brother of the previous Locomotive Superintendent.

The starting difficulties and other "temperamental" characteristics of compound locomotives built up to that time no doubt influenced the designer in his aim to produce a "general utility" type of compound, or one that could adapt itself to all conditions of working. Therefore the Smith system provided for the operation of the engine either as a compound or as a simple, while there was also an intermediate semi-compound stage. No. 1619, as rebuilt, had one inside high-pressure cylinder and two outside low-pressure cylinders all driving on the same axle. The system was therefore exactly opposite to the Webb three-cylinder plan. The outside crank pins were set in the usual manner at right angles to one

another, while the inside pin was at 135 degrees to the other two, thus bisecting the obtuse angle between them. This crank setting has been adhered to in subsequent three-cylinder compounds built on this system.

When starting the engine as a compound, boiler steam was admitted to all three cylinders, directly in the case of the high-pressure unit, and through a reducing valve to the low-pressure ones. This valve, which could be controlled from the cab, was placed on the side of the smoke-box. After the first exhaust from the high-pressure cylinder the live steam supply to the low-pressure units was cut off, and the high-pressure exhaust steam took its place. If the high-pressure exhaust pressure fell below the limit set by the reducing valve, however, a supplementary supply of live steam from the boiler automatically helped to restore the pressure, so that the power output of the low-pressure units would be maintained. At the same time the maximum pressure allowed in the low-pressure steam chests could not be exceeded. Further, if the pressure in the high-pressure cylinder was below the receiver pressure, steam could pass to either side of the high-pressure piston by means of non-return valves, thus preventing excessive forward or unnecessary back pressure on it, which conditions might obtain in certain positions of the cranks when starting.

By manipulation of the control the driver compressed the spring of the reducing valve and so increased the pressure of the steam passing to the low-pressure cylinders. Still further compression resulted in the admission of live steam to the low-pressure cylinders, while the high-pressure piston was placed in equilibrium by steam being admitted to each side of it. A piston valve was used to govern the admission of steam to the high-pressure cylinder, but ordinary slide valves were used for the low-pressure ones, each being operated by Stephenson's link motion. The boiler pressure was 200 lb. per sq. in. and cross water tubes were introduced in the fire-box. Later these tubes were done away with as they were not entirely satisfactory, and the pressure was reduced.



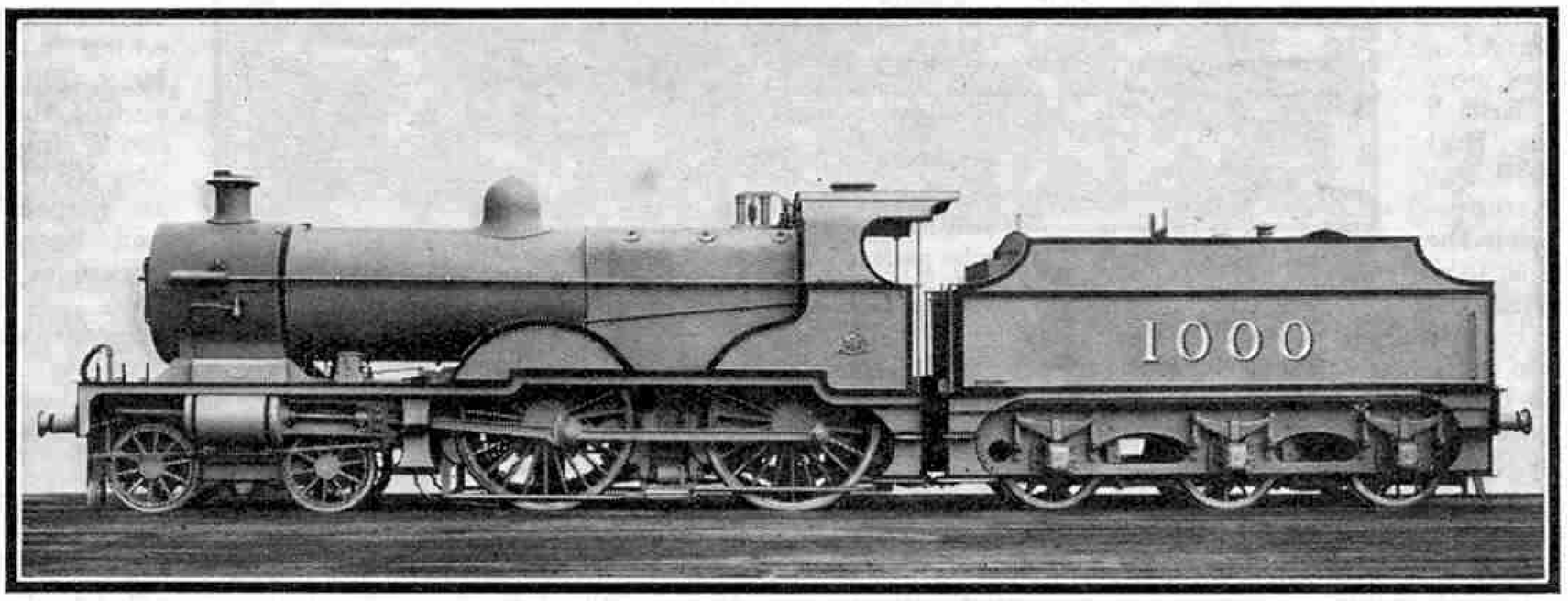
One of the original "Smith" compounds of the Midland Railway. These were first introduced in 1902, and, as the photograph shows, were very different in external appearance from the Midland compounds of the present day.

The Smith compound system proved entirely satisfactory, but strangely enough no further examples were built on the North Eastern. The capabilities of No. 1619 were well shown by its work in 1898 on the 10 a.m. "*Flying Scotsman*" between Newcastle and Edinburgh. On two occasions the load was 372 tons behind the tender, while the mean average speed was 48.3 m.p.h., although the schedule involved a rate of 47.2 m.p.h. This decidedly interesting and quite handsome engine was withdrawn from service in 1930, and unfortunately broken up.

We must now make some mention of the French "De Glehn" arrangement, that was applied for the first time in this country in 1903 on the G.W.R., although the system had originally been evolved in France in 1886, and met with remarkable success. It involved a four-cylinder arrangement with two outside high-pressure cylinders and two inside low-pressure cylinders, the drive being applied to separate axles. In the first engine on the Nord Railway, the driving wheels were not coupled by side rods, but in subsequent engines constructed from 1891 onward this was done. A splendid reputation was enjoyed by the Nord "Atlantics" operating on the De Glehn system some 30 years ago, and their work aroused considerable interest over here.

Soon after taking office at Swindon, Mr. G. J. Churchward obtained permission to order one from France. It was put to work in October 1903, and appropriately named "*La France.*" It was practically a duplicate of the standard Nord "Atlantic" engines of the day, and was the first 4–4–2 engine on the G.W.R. Its high working pressure of 227 lb. per sq. in. resulted in the adoption of the pressure of 225 lb. in the G.W.R. engine No. 171 "*Albion*" that ran in comparative trials with it. This engine, then representative of the most up-to-date G.W.R. simple practice, was built as a 4–6–0, but in order to make the tests more fair it was converted in 1904 to a 4–4–2 and became the prototype of several Swindon "Atlantics." It later reverted to its original type, and the others were similarly dealt with in due course.

The appearance of "*La France*" as first delivered is shown in the illustration on the previous page. A similar cylinder plan with divided drive and a high steam pressure was adopted at Swindon in 1906 for the simple engines of the "Star" class, and these features have been included in subsequent G.W.R. multi-cylinder designs, and in the new L.M.S.R. "Pacifics" designed by a former G.W.R. engineer. The division of the effort over two axles and the high steam pressure were notable characteristics of the De Glehn system, and in addition separate sets of Walschaerts valve gear were provided to allow of separate points of cut-off in the high-pressure and low-pressure cylinders.



A Midland compound locomotive incorporating the modifications, both internal and external, introduced by Mr. R. M. Deeley. The engine shown, No. 1000, was the first one built in 1902, and originally had the same appearance as No. 2632 in the upper illustration. The photographs on this page are by courtesy of the L.M.S.R.

In 1905 two more De Glehn compounds were built for the G.W.R., of rather larger size, and representative of the Paris-Orleans type of that time. These followed the same general design as "*La France,*" but had larger boilers, were heavier, and differed in several details. Good work was done by all of them, but the type was not further multiplied. Their high pressure and moderate adhesion weight, together, possibly, with the more humid atmosphere of this country than that of their native land, made them prone to slipping, but they were extremely fast-running engines, and as stated some time ago by Mr. W. A. Stanier they "were in many ways beautifully designed and an inspiration to all." They were all eventually fitted with G.W.R. domeless tapered boilers, but have now been withdrawn from service for some years. There are now no compounds on the G.W.R.

The original "Midland Compound" design originated in 1902, when the first two such engines designed by Mr. S. W. Johnson left Derby Works; and in the following year three more were built. In external appearance they differed considerably from the engines now familiar to most of our readers, as a comparison of the accompanying illustrations will show.

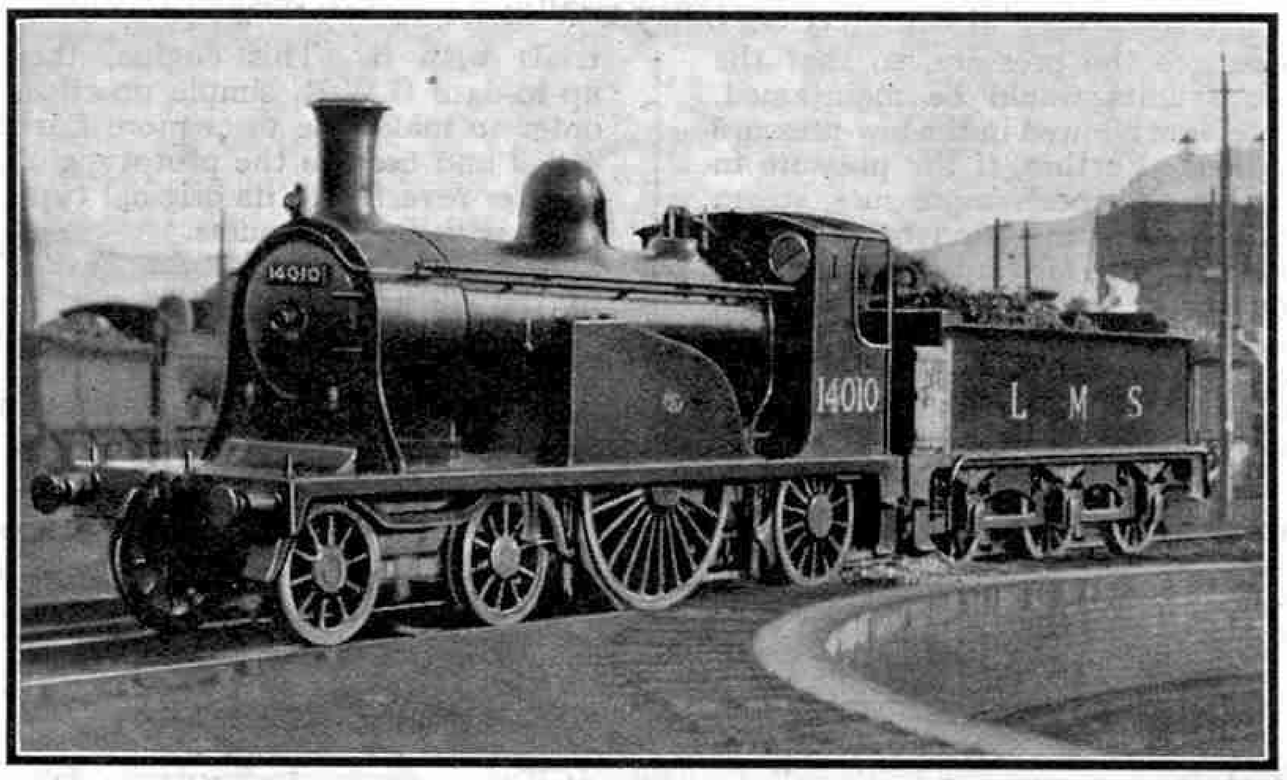
(*Continued on page 763*)

Scotland's Only Bogie "Single-Wheeler"

The Last of a Great Race

IN these days of six-coupled express locomotives with adhesion weights of over 60 tons, it is remarkable that an engine with a single pair of driving wheels, on which rests a weight of only 17 tons, should still be engaged in regular passenger service. This sprightly veteran is L.M.S.R. No. 14010, and is 47 years old. The age of the engine, and the fact that it is the last single-wheeler to be employed regularly on passenger duties, makes the photograph reproduced on this page of particular interest.

The engine also has an unusual history, for it is the only bogie single-wheeler that has ever belonged to a Scottish railway. The 4–2–2 engines of the former North Eastern Railway ran into Scotland over the North British route from Berwick, but as a true Scottish product No. 14010 is unique. Single-wheelers of the 2–2–2 variety at one time were very common in Scotland, the "8-footers" of the Caledonian being particularly well known; but the familiar 4–4–0 wheel arrangement was early adopted as loads increased, owing to the severe conditions prevailing in the matter of gradients. Thus No. 14010 is the solitary example of a Scottish 4–2–2, though large numbers of these engines were in use on the Great Northern, Great Western and Midland railways, while the Great Eastern also had a few.



The last "single-wheeler" in regular passenger service. L.M.S.R. No. 14010, formerly Caledonian Railway No. 123 at Perth shed where it is now stationed for working to and from Dundee. For this interesting photograph we are indebted to our reader J. C. Moncrieff of Perth.

In 1886 an exhibition was held at Edinburgh, and it was as a specimen of the work of Messrs. Neilson & Co. as locomotive builders, now part of the North British Locomotive Company, that the present No. 14010 was designed and built. Arrangements were made with the Caledonian Railway to take over the engine after the exhibition, and certain features of the then standard practice of that company were incorporated. Thus the cab, boiler mountings and other details caused the engine to appear a close relative to the 4–4–0 express engines designed by Mr. D. Drummond, who was in charge at St. Rollox at that time. The safety valves were mounted on the dome, the sand-boxes were made in the form of extensions to the driving wheel splashers, and sheet metal "wings" were fitted at the side of the smoke-box front. These wings are still retained, as the photograph shows, but other Caledonian locomotives that were at one time similarly fitted have had them removed.

Soon after being put into service from Edinburgh to Carlisle and back, No. 123, as it was then, had splendid opportunities to show the quality of its work. In 1888 the competition between the East and West Coast Routes for the traffic to Scotland resulted in the well-known "race to Edinburgh." Each acceleration by one side was immediately followed by a corresponding cut in timings by the other. No. 123 was used throughout the month of August 1888, which was spent by each rival in trying to get to Edinburgh before the other. With a load of four coaches it covered the 100¾ miles from Carlisle to the Scottish capital in the total average time of 107¾ minutes. On one occasion on 9th August, the distance was run in 102 minutes 33 seconds, and in view of the nature of the route this was a remarkable piece of work. The maximum speed attained was not unduly high as modern speeds go—73.4 m.p.h.—but the climbing to Beattock and Cobbinshaw Summits was very fine. Up the last mile of the 10-mile Beattock incline 36.7 m.p.h. was maintained and 54.5 m.p.h. was the speed at which Cobbinshaw was breasted after climbing practically all the way from Strawfrank Junction, where a slack, as was usual, had been made, to 36 m.p.h. The very good average speed of 58.94 m.p.h. was therefore the result of running of a high order, and was not due merely to excessive speeds on favourable stretches.

For some time after the racing the engine ran daily with the 10 a.m. express from Edinburgh to Carlisle, returning later. Although these trains were not so speedy as the racing trains, they were much heavier, but the engine did very well. Later it was transferred to Carlisle and worked to Glasgow, making a daily mileage of 409 miles, as the journey there and back was covered twice. It was then moved to Perth and ran between there and Aberdeen.

Like many other famous engines of the past, No. 123 was in due course taken out of regular service and used for hauling official specials. The number was assigned to another locomotive, the single-wheeler becoming "1123." On the formation of the L.M.S.R. group, the present number 14010 was given to the engine, and it was painted in the style at first settled upon for all L.M.S.R. passenger engines. This has now given place to the black paint with red lining that has been adopted for secondary passenger engines.

In May 1930 the engine was reinstated in the traffic list and so became the last single-wheeler in regular passenger service. The engine that had claimed that title previously was No. 600 of the Midland section, which was withdrawn in 1928. This was also a 4–2–2, one of the famous "Johnson" single-wheelers; and like No. 14010 it had been an inspection engine that had been put back into passenger service to end its days. No. 14010 was therefore allocated to Perth and set to work between there and Dundee, a stretch of road with quite moderate gradients. The usual working consists of four return trips each day, and the engine fills in odd moments in carrying out various duties.

It was rumoured that No. 14010 was to be repainted in her original Caledonian livery and shown at the Liverpool and Manchester Railway Centenary celebrations in Liverpool in September, 1930. This was not done, but the L.M.S.R. have decided that when its running days are over this famous engine will be spared from the derelict road, in view of its history and unique position. Caledonian Railway enginemen with whom it has long been a great favourite will then be more proud than ever of their "single-coupled" locomotive, as they call it.

The boiler now fitted to the engine is of the pattern evolved by Mr. J. F. McIntosh for his "812" class 0–6–0 goods engines. In this the safety valves in their usual position over the fire-box replace those provided on top of the dome in the original boiler. One characteristic "Drummond" feature is thus eliminated, but apart from this, little difference appears to have taken place in the external appearance of the engine. With a single pair of driving wheels it is very necessary to provide against slipping. The engine therefore has power sanding gear, but instead of steam, compressed air is used, the engine being provided with a Westinghouse brake pump.

The preservation of the engine will be a popular move, and it is hoped also to keep other historic engines belonging to the company and to accommodate them if possible where they have local associations. Railway enthusiasts will eagerly await the time when these veterans are duly installed for their inspection and admiration. The old 0–4–2 "*Lion*" of 1838, that is on show at Lime Street Station, Liverpool, continues to arouse considerable interest.

Locomotive Washing on the C.N.R.

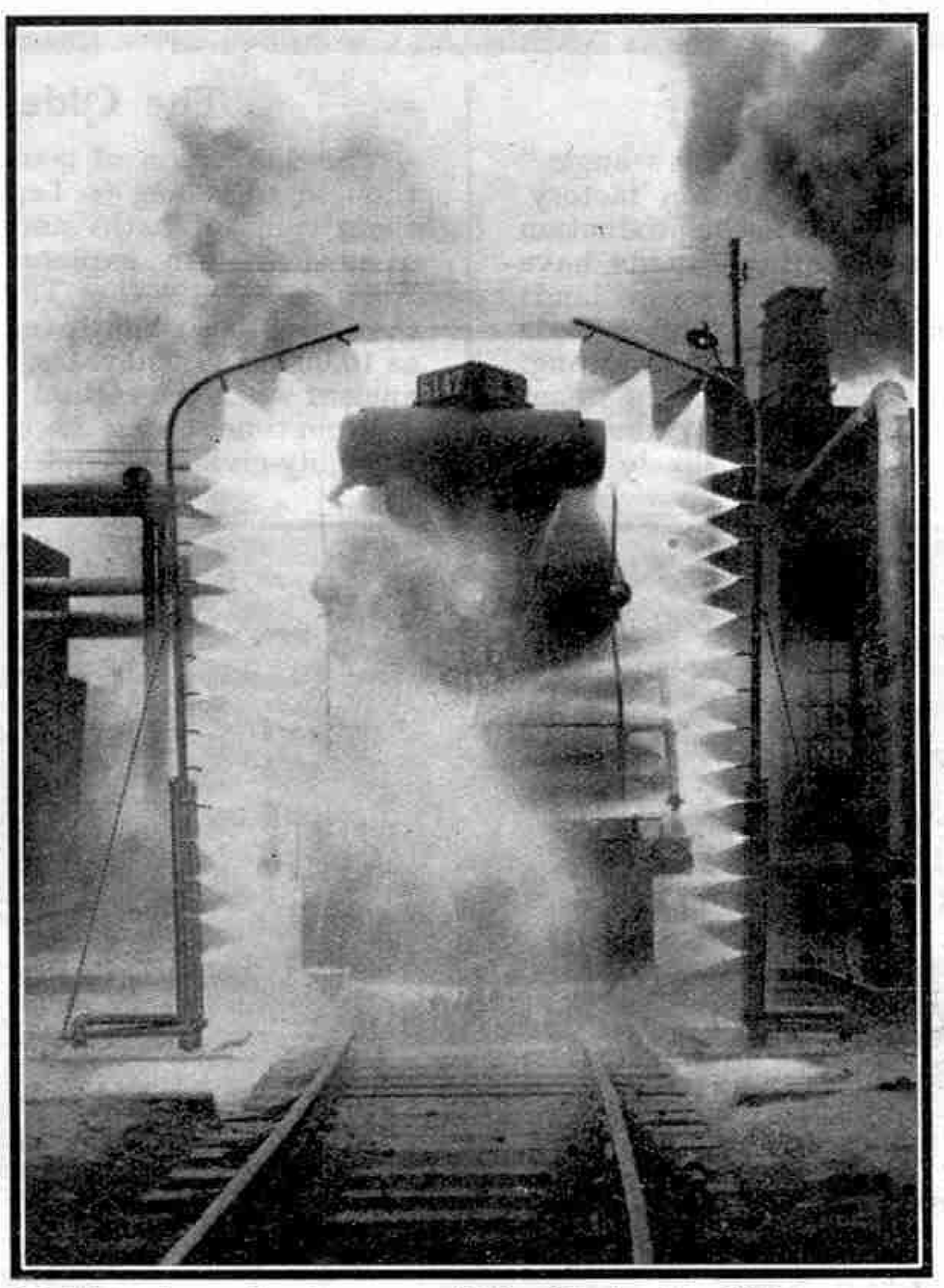
High-Pressure Hot Water Plant

THE cleaning of locomotives is responsible for a considerable item in the operating costs of any railway, but this expenditure is necessary. Even if the advertising value of a smart appearance is disregarded, it is essential that locomotives should be kept clean, as adequate inspection of the working parts is practically impossible if they are smothered in dirt.

The Canadian National Railways have installed an interesting locomotive washing plant at Turcot Engine Shed in Montreal, with the object of cutting the cost of locomotive cleaning and also reducing the time required to perform the work. In busy seasons the reduction of time taken in cleaning is quite as important as the reduction in cost, because, by shortening the layover period at terminals, the hours of actual service of the locomotive are correspondingly increased.

The washing plant consists of an arrangement of pipes equipped with specially designed nozzles, through which hot water at high pressure is sprayed on to the locomotive as it passes slowly through the washing zone. The accompanying illustration shows the pipes in the operating position, but their normal position when idle is with the nozzles pointing parallel with the track, in order to give the standard track clearance.

The operation of the plant is entirely automatic, and all that the cleaner has to do is to close the cab windows and ventilators and move the engine very slowly. As the washing plant is approached, the front pair of wheels close a low voltage electrical circuit, and the pipes automatically swing into the operating position. A valve actuated by means of a solenoid is then opened, and the water is automatically turned on at the same instant as the front of the engine comes within range. As the back of the tender leaves the spray nozzles the electrical circuit is broken, the valve closes, and the pipes swing back to their normal position. The area surrounding the plant is covered with a concrete floor with a low curbing, so that all waste water is taken directly to the sewer.



Washing a locomotive by means of jets of hot water at high pressure. Photograph by courtesy of the Canadian National Railways.

The water used for washing is maintained at a pressure of 140 lb. per sq. in. by means of a motor-driven centrifugal pump that starts and stops automatically with the demand, and the water is fed through a closed-type heater in which the temperature is raised to about 150 deg. F. Before the water reaches the spray nozzles a small amount of cleaning compound is added, averaging about one gallon per engine washed. This cleaning compound is purchased to a special formula, and serves a double purpose. It assists in dissolving oil and grease on the surface to be cleaned, and leaves on the washed surface a light film of wax that acts as a renovator on paintwork and a preventative of rust on bright steel.

The quality of the work done by this washing machine depends to a very large extent on the cleaner who takes the engine through. If he runs the engine dead slow, hesitating at such points as may need extra attention, a good result is obtained, and so far as freight and shunting engines are concerned hand wiping is not necessary. Passenger engines are wiped by hand after passing through the machine, but even in this case the washing reduces the work very considerably, and the wax-like film that is left on the surface is found to wipe to a very nice finish. This process adds to the number of locomotive preparation and disposal operations that can now be carried out mechanically. Coaling and ash disposal are already performed by special plant.

Aircraft Developments—(*Continued from p. 755*)

It may be equipped with one "Cirrus III" or D.H. "Gipsy II" engine and it is 37 ft. 3½ in. in span and 25 ft. in length. It weighs 1,061 lb. when empty and 1,640 lb. when fully loaded. Its maximum speed is 102 m.p.h., and it lands at 48 m.p.h.

The last of the aeroplanes to be dealt with in this article is the Short "Valetta," which was fully described and illustrated on page 940 of our issue for December 1930. This machine is the largest seaplane in the world, and it was the type selected by Sir Alan Cobham for his most recent survey flight in Central Africa. The machine is a triple-engined seaplane with accommodation for 17 passengers, and is an all-metal high wing monoplane measuring 107 ft. in span.

The machine is provided with an enclosed cabin for the pilot right in the nose, and this has two side-by-side seats. Immediately behind it is the luggage compartment that can also be used as a wireless cabin. The main passenger cabin is 17 ft. in length, 6 ft. in height and 6 ft. 2 in. in breadth.

The "Valetta" is equipped with three Bristol "Jupiter" engines each of which develops between 490 and 525 h.p., and it has a maximum speed of 135 m.p.h. and is capable of cruising at between 105 and 110 m.p.h. for more than four hours, during which time a distance of 520 miles can be covered. As the floats are streamlined they do not greatly decrease the speed, for the landplane version has a maximum speed only 3 m.p.h. higher than that of the seaplane.

Locomotive Economy—(*Continued from page 761*)

Large bogie tenders, then used to some extent on the Midland system, were provided, while the form of the footplating differed noticeably from the present arrangement.

These five engines, Nos. 2631-35, followed the general design of the North Eastern No. 1619, but the low-pressure cylinders were larger in diameter. The Belpaire pattern of fire-box, then a recent innovation in Midland practice, was used, and the steam pressure was fixed at the rather curious figure of 195 lb. per sq. in. The driving wheels were fairly large—7 ft. in diameter—as in the case of the North Eastern engines, and independent valve gears were provided for the high-pressure and each low-pressure unit. These locomotives immediately gave good results on the Midland, being free running and economical. Mr. R. M. Deeley, who assumed command at Derby in 1903, modified the Smith system somewhat in the compound engines of his own build, and the five of 1902-3 were subsequently altered to suit.

The alterations effected by Mr. Deeley, which resulted in the application of the name "Deeley Compounds" to these Midland engines, simplified to some extent the main details of the Smith system. The reducing valve arrangement w s done away with and a special form of regulator substituted for it, incorporating three steam ports. One of these is connected with the low-pressure cylinders by means of a small auxiliary steam pipe. The main regulator valve has a small jockey valve on the back of it, which, when the regulator handle is first moved by the driver at starting, gradually uncovers two of the ports, one of them being that leading to the small auxiliary steam pipe. Thus steam is admitted to all three cylinders, but as the non-return valve equalising arrangement of the original design is retained on the high-pressure cylinder, it will be realised that the high-pressure piston is maintained in equilibrium with steam on each side of it.

The engine thus starts as a two-cylinder simple. As the regulator handle is moved over the auxiliary port closes and steam is admitted directly to the high-pressure cylinder only, fully compound working being thus obtained.

The external modifications in the Deeley engines were rather drastic. The shape of the footplating was altered, and the large rectangular cab splashers were done away with. The cab roof was extended and supported by pillars, and also provided with a ventilator. The narrow Deeley chimney, with its parallel sides, high capuchon and severely-shaped rim, replaced the more chubby Johnson erection, and the original safety valve cover was omitted. The new six-wheeled tenders were of course quite different in appearance from the Johnson "water carts," as these were known.

The working pressure was raised to 220 lb. per sq. in., but 200 lb. subsequently became the standard figure for the class. The application of superheaters to the design first occurred in 1913.

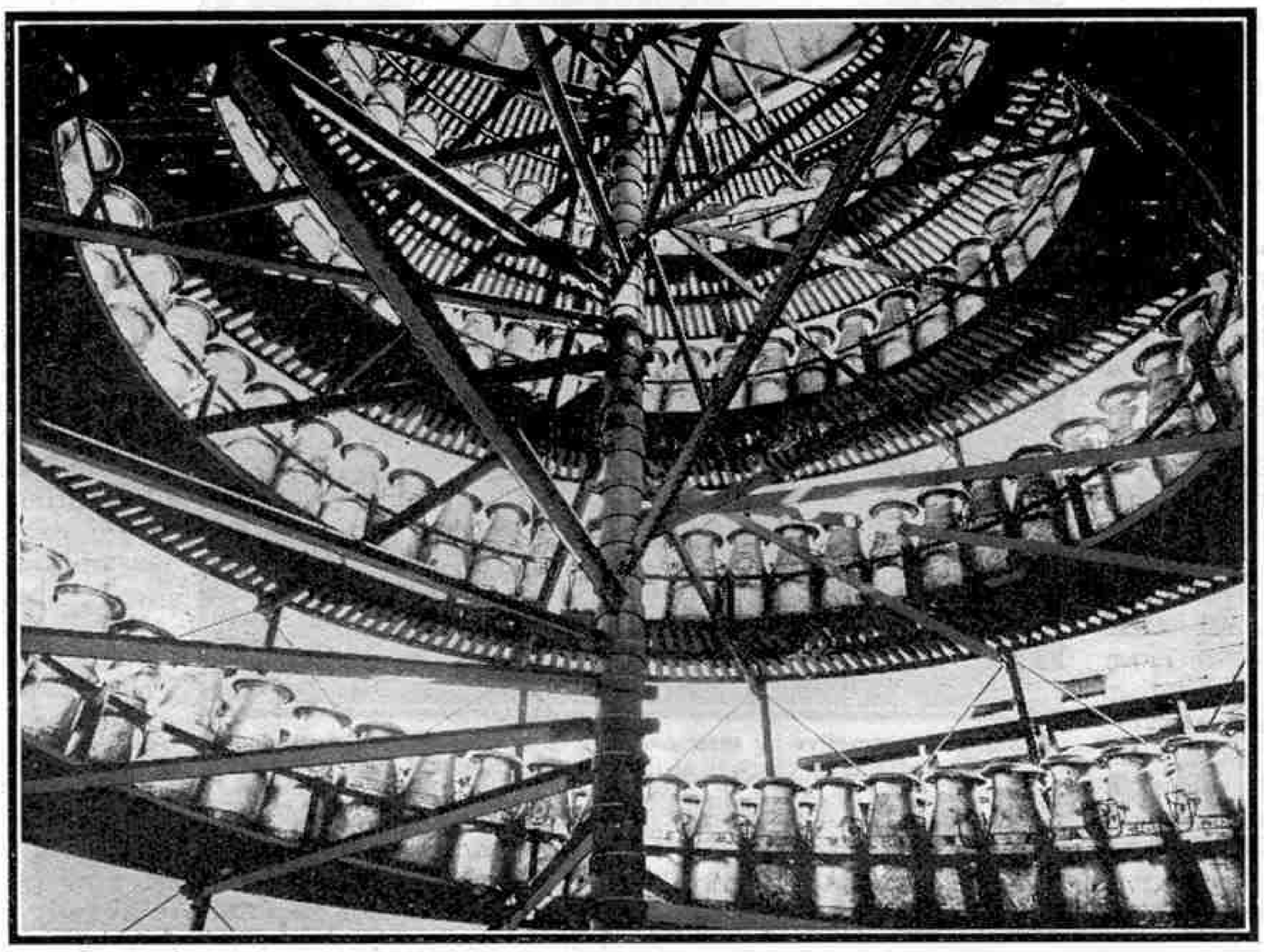


Of General Interest

Milk Churns' Merry-go-round

The illustration on this page shows a striking "new-angle" view of the milk churn tower of Cadbury's Knighton factory. Thirty thousand gallons of milk are used every day in the production of milk chocolate at Bournville, and special arrangements have to be made at Knighton, in the heart of the rich pasture lands of West Staffordshire and Shropshire, to accommodate the hundreds of churns which arrive by rail, road and canal boat every morning.

A special plant cleans the churns with powerful blasts of steam and they are then elevated to the top of the circular tower to dry in the fresh country air. From there they glide slowly down on a gravity roller conveyor to the lorries on which they are taken back to the farms.



The milk churns' merry-go-round at Cadbury's factory at Knighton, Shropshire. The churn cleaning plant of which this tower forms part is described in the accompanying paragraph.

Dyeing the Lily

The schoolboy trick of placing the stem of a white flower in an ink-well and watching the hue of the petals change slowly to blue or red has been transformed into a system for dyeing white flowers red, pink, yellow, green or blue. For this purpose a range of synthetic dyes has been introduced by Imperial Chemical Industries. These are easily made up into solutions, and the petals of flowers are dyed by simply standing their stems in the coloured liquid until a sufficient depth of colouring is attained. They retain their colour when placed in fresh water.

The new process has been particularly successful in dyeing white lilies, and it is said that flowers treated in this manner remain in good condition for a longer time than those that are not treated.

A Fourth Pyramid Discovered

The shifting of the sand at Gizeh, near Cairo, has revealed the former existence of a fourth pyramid. When the highest portion of the remains of this emerged from the desert it was supposed to be part of a mastaba, or tomb cut out of the rock, but signs of masonry were discovered when the site was cleared, and eventually the ruins of the pyramid came to light after being hidden in the sands for thousands of years.

The newly-discovered pyramid is believed to have been constructed about 2,500 B.C. as the tomb of an important queen, and other tombs that appear to have been the resting places of royal princes have been discovered in the court surrounding it. Its southern side had been weathered out of shape by desert storms. The structure generally is in a ruined condition, and at one time seems to have served builders as a stone quarry. The blocks of masonry of which it is built are larger than those of the other pyramids, and the passage leading from the entrance of the tomb to the centre is remarkable for the presence of enormous granite slabs.

The Oldest City in the World

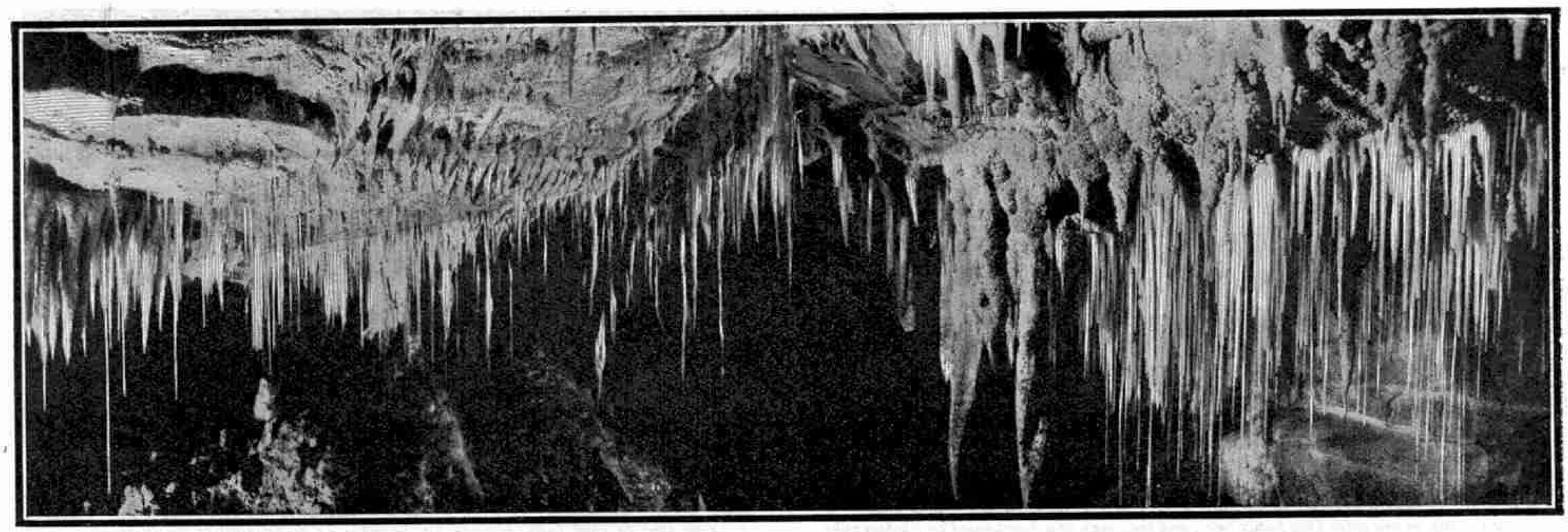
The distinction of being the oldest known city in the world is thought to belong to Tepe Gawra, in Northern Mesopotamia, for there ruins of baths and bazaars of 6,000 years ago have been discovered. An explorer who has travelled largely in South America believes that Tiahuanaco, on the shores of Lake Titicaca, may have been built even earlier, however. He estimates its age as 10,000 to 14,000 years, and if he is right, Tiahuanaco was already ancient when the earliest cities known in the Old World were built.

From time to time discoveries are made that suggest the existence of highly-civilised peoples at a much earlier age than was formerly thought possible. For instance, relics have been found of a settled agricultural people who flourished in the valley of the Nile more than 7,000 years ago, long before the rise of historic Egypt. Very ancient civilisations may have flourished also in South Africa and India, and even in the New World, for South West Colombia in South America is now known to have been the home of a prehistoric race whose existence was unsuspected until very recently. The members of this ancient race were sufficiently advanced to construct irrigation works and to carve splendid statues from immense pieces of solid rock, moving them over great distances by some unknown means of transportation. Similar mysterious finds have been made in other parts of South America, and further discoveries may reveal the existence of civilised races older than the Peruvians overthrown by the Spanish conquerors in the 16th century.

Tides in the Earth

The Earth's surface is far from being as solid as might be supposed, for actually it may move as much as 10 ft. during the course of a single day. The cause of the movement is a tide in the material of the Earth's crust. Like the tide in the sea, this is caused by the Moon, and it has been detected by means of very accurate measurements of slight daily changes of latitude of certain chosen places. The Earth yields to the gravitational pull of the Moon with about the same elasticity as steel, and the slight yield damps down the ocean tide, making it a trifle lower than it would be if the Earth were rigid.

It is interesting to learn that even larger changes of latitude are brought about by the wandering of the North Pole over the Arctic ice fields, for this changes its position by as much as 60 ft. in its continuous movements. The motion is periodic, the Pole returning to any given position 426 days after leaving it, and is evidence of a slight oscillation of the Earth's axis.



Meteoric Craters in Central Australia

Central Australia was once the scene of the fall of a group of giant meteorites, and great holes in the ground, similar to Meteor Crater in Arizona, mark the place where these wanderers of the sky struck the Earth. Most of the holes are circular, the largest of this type being 80 yds. in diameter; but one is approximately oval in shape and is 220 yds. in length and 120 yds. in width. They are all much smaller than the gigantic American crater, which was fully described in the issue of the "*M.M.*" for March 1933, for this is nearly a mile in diameter.

It is at present impossible to say when the craters were excavated by the swarm of meteorites responsible for them, for the natives of Central Australia do not appear to have any legends or stories to account for their formation. About 800 meteoric fragments have been discovered in the neighbourhood of the holes, and it seems certain that they were made by a very compact group of small meteorites. In this respect they are intermediate in character between the results of the two falls previously known—the single gigantic hole in the Earth in Arizona, which must have been made by a very compact group of immense size and mass; and a series of small craters in Siberia that were formed in 1908 by the collision of the Earth with a swarm consisting of at least 150 scattered meteors. The smallest of the Australian craters is about the same size as the largest in Siberia.

The discovery of meteoric craters in Australia suggests that the risk of collisions of this kind is a little greater than was formerly thought to be the case. If any one of the three visitations now known had fallen on present-day London or New York, the loss of life and the destruction of property would have reached appalling dimensions. The danger is still very remote, however, for it is more than 1,000 years since the meteorites of Arizona collided with the Earth, and the Siberian fall is the only one of which we have record in historical times.

Roman Millstone on Lancashire Farm

A stone used as a support for a milk can on a farm at Lathom, near Wigan in Lancashire, had been familiar to the workers on the farm as long as they could remember, and they had become so accustomed to it that they saw nothing unusual in it. A visitor who remarked its peculiar shape had it examined, and the result was the surprising discovery that it was a Roman millstone. It was the upper half of a quern, or stone hand mill, and a search for the lower half brought this to light in an orchard near the scene of the original discovery.

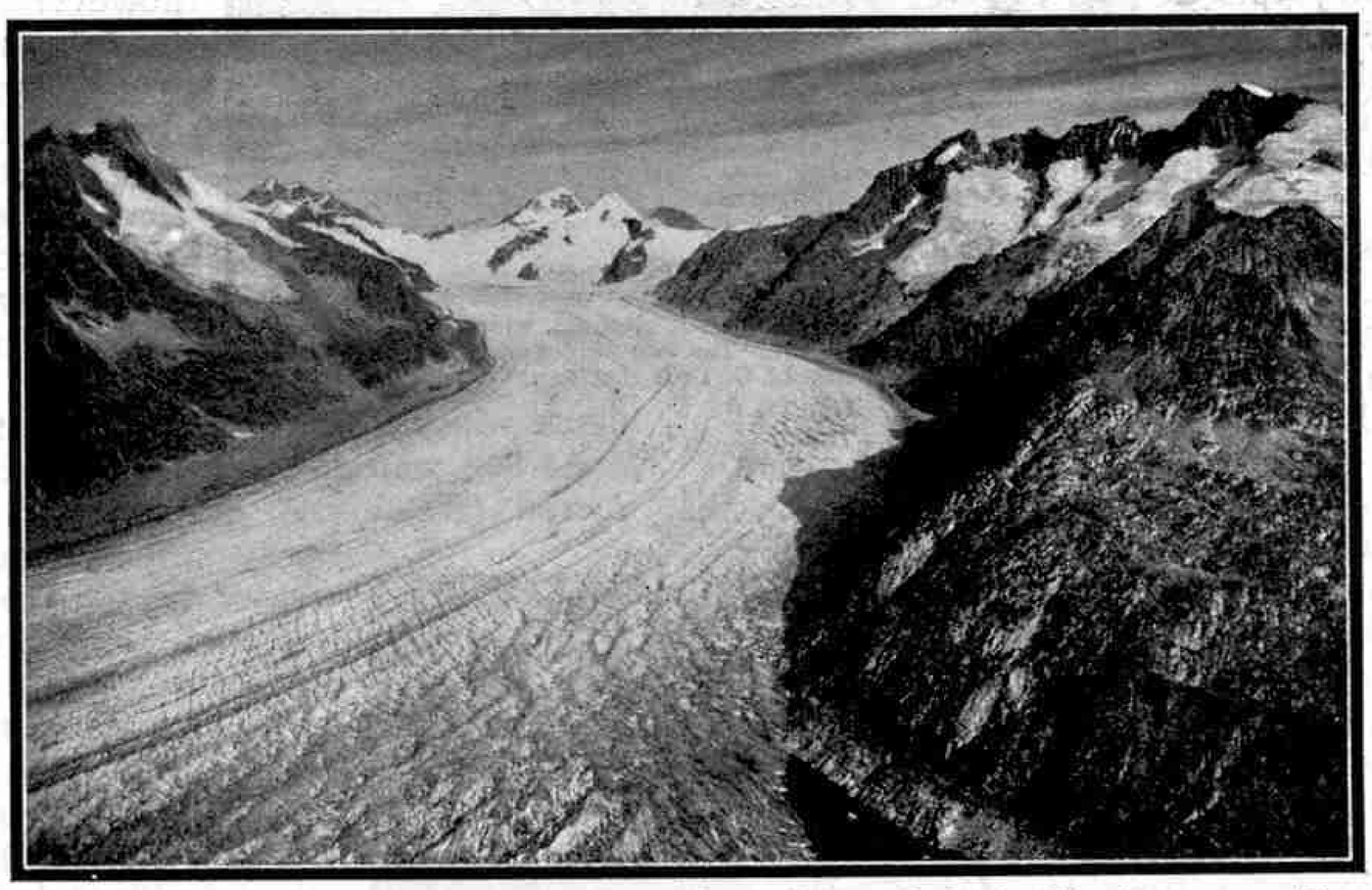
The quern must have been made earlier than 426 A.D., the date when the Romans left Britain, and since Roman coins and other relics have been found in the neighbourhood, it is probably a reminder of a Roman colony at Lathom. The surrounding country therefore may have been actively cultivated more than 1,700 years ago, and even earlier, for the Britons grew corn hundreds of years before the Romans came. Thus the farm on which the millstones were found may have a record of more than 2,000 years of cultivation.

High-Frequency Current Used in Surgery

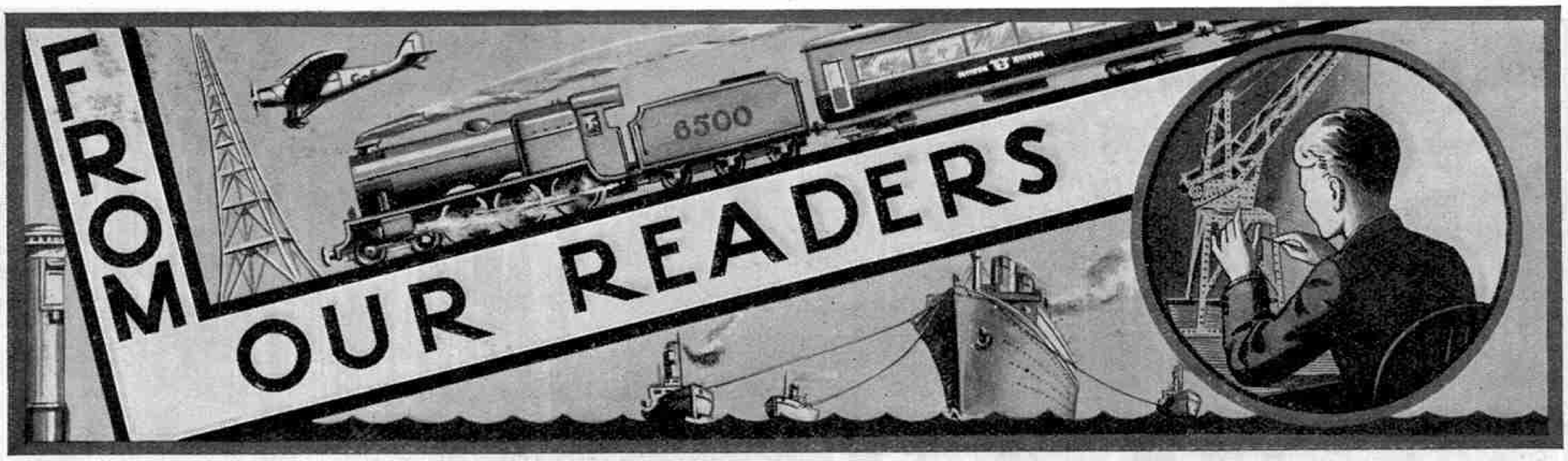
One of the most remarkable discoveries of recent years has been that of the high-frequency knife now used in surgery. This effectively seals the ends of capillary blood vessels through which it cuts, and the severed ends of larger blood vessels may be closed by simply nipping them by means of forceps and touching the metal portion of this instrument with the high-frequency knife.

The implement with which this miracle of bloodless surgery is effected consists of a thin needle, mounted in an insulating handle, that acts as the cutting edge and is called the active electrode. This is connected by means of a flexible coupling with one terminal of the generator, and the tissues to be cut through are placed in contact with a metal plate, called the indifferent electrode, connected to the other terminal. When the point of the needle is brought almost into contact with the tissues an arc is struck, and this spreads out to form a sheath around the needle as it cuts through them. It is this arc that divides the tissues, and it again becomes visible at the moment when the knife is withdrawn.

High-frequency current is coming into use also for the production of an artificial fever, or rise of temperature, as a means of getting rid of some infection. For this purpose the patient is placed between two large plate electrodes connected to the terminals of a high-frequency generator, and his temperature then rises to 103°F., or even as high as 105°F. One of the diseases treated in this manner is general paralysis. A few years ago it was discovered that in certain instances this disease could be cured by giving the patient a mild form of malaria. It is now believed that the good results that followed were due to the rise in temperature, and not to the special action of malaria itself. High frequency treatment therefore is being substituted with equal success, and of course with much less risk than that introduced by even a mild form of malaria.



The photograph at the head of the page shows a range of magnificent stalactites in a limestone cavern. The Aletsch Glacier, the longest in Switzerland, is seen in our lower illustration. This great sheet of ice is 15 miles in length and more than a mile in width.



These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

An Intelligent Ceylonese Elephant

During a recent holiday I accompanied some friends on a motor tour of the hill country of Ceylon, and in the course of this outing obtained many photographs of interesting scenes. Two of these are reproduced on this page, and illustrate the wonderful intelligence of a tame elephant that we met in charge of its mahout during our journey. The animal first seized its keeper in its trunk, raised him high in the air, and put him gently down again. Then the mahout lay on the ground, and the elephant stood over him and gradually lowered itself by moving its forelegs forward inch by inch. Finally its vast bulk actually touched the man, and seemed ready to crush him to death. At a word the great animal raised itself, however, and the smiling mahout stood up again, his confidence in the creature justified.



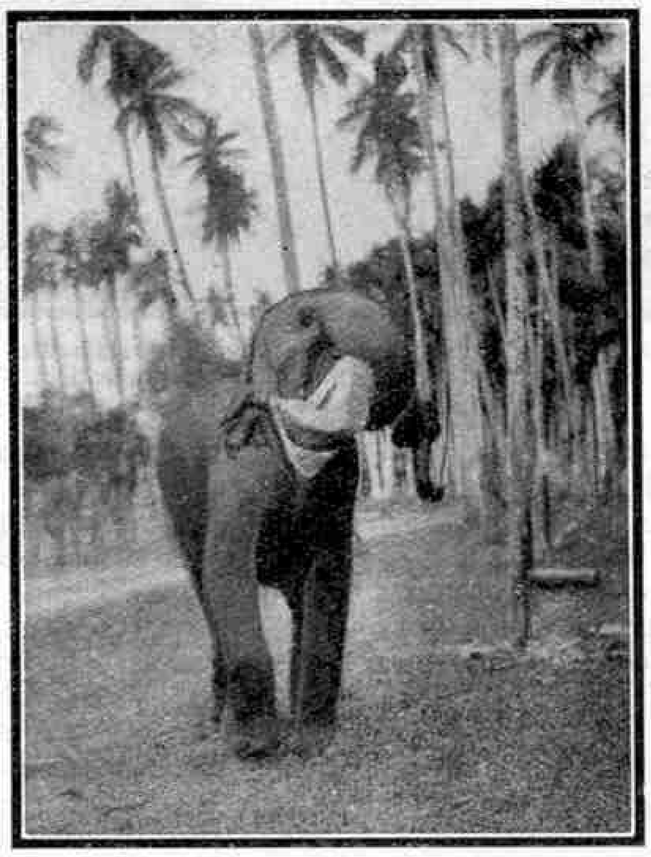
A daring trick with a tame Ceylonese elephant, which lowers itself until its bulk touches its mahout. The two photographs on this page are by L. G. Loos (Ceylon).

The elephant shown in the illustrations also performed several other tricks, including walking first on the hindlegs and then on the forelegs, and many other evolutions that circus elephants usually carry out.

Elephants are very numerous in Ceylon. Every jungle is the home of wild elephants that from time to time are captured by driving them into kraals. The creatures are then tamed and put to such work as assisting in the erection of bridges, opening out new roads, clearing forest land and other tasks in which their giant strength is of great value.

Elephants take part in an interesting annual festival in the streets of Kandy, the capital of Ceylon. This festival is known as the "Dalada Perehera," or procession of elephants, and commemorates the triumphant return of 12,000 Ceylonese who had been held captive in Southern India for many years and were restored to their native country after a great battle. Sixty to 80 elephants walk in the procession.

L. G. Loos (Ceylon).



The performing elephant shown in our upper photograph carrying its mahout in its trunk.

The Source of a Sacred Indian River

Recently I and a few friends had a splendid opportunity of visiting the source of the Godavari, one of the sacred rivers of India. We had to travel a distance of about 24 miles by motor in order to reach the foot of the hills in which it rises, and on arrival there we saw several temples, and near them a great flight of steps up which we were to climb. This was not a difficult task for us, however, for hillmen were waiting to take us up in "machaus," which resemble cradles suspended from a long pole, the ends of which rest on the shoulders of the carriers. As we climbed higher and higher the air became pleasantly cooler, and when nearing the top we were surprised to find on looking backward that dense white clouds below us obscured the foot of the hill.

At last we reached the top, and saw the source of the sacred stream. A building has been erected near a perpendicular rock from which the water falls, to be collected and forced through a pipe passing under an iron structure shaped like an inverted U. A native priest showed us how the water is collected and kindly gave each of us a drink of it from a "lotah" or cup.

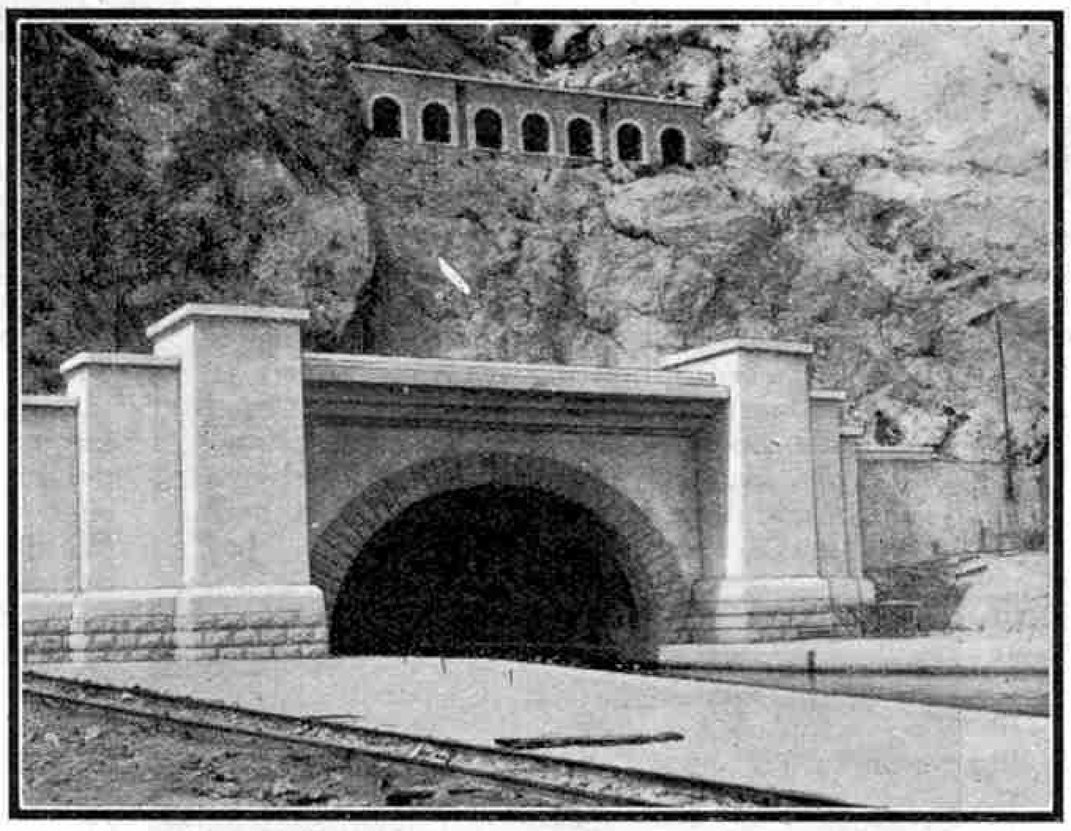
Our visit to the source of the secret river fortunately was made immediately after a period of fairly heavy rainfall. In consequence there was a copious flow of water through the pipe, but the priests told us that in hot dry seasons the stream becomes a very slow trickle.

We decided to walk down, and on the way one member of our party counted the number of steps. These were in groups of three with short landings between the sets, and we were astonished to find that there were more than 800 of them. The descent was extremely interesting, for it gave us the opportunity of examining the temples that had been erected at the many sacred pools that exist along the course of the stream.

M. de Lima (Bombay).

The World's Longest Canal Tunnel

While staying in the South of France I visited the entrance to the wonderful tunnel by means of which the Rove Canal is carried under the Estaque Ridge to the north east of Marseilles. This tunnel is the longest of its kind in the world, measuring nearly five miles, and its construction was one of the greatest engineering feats of modern times. It is 47 ft. in height and 70 ft. in width, and the water in it has a depth of 13 ft. The accompanying photograph shows the entrance to the tunnel on the south, or Marseilles side, and above the opening can be seen a viaduct that carries a railway line.



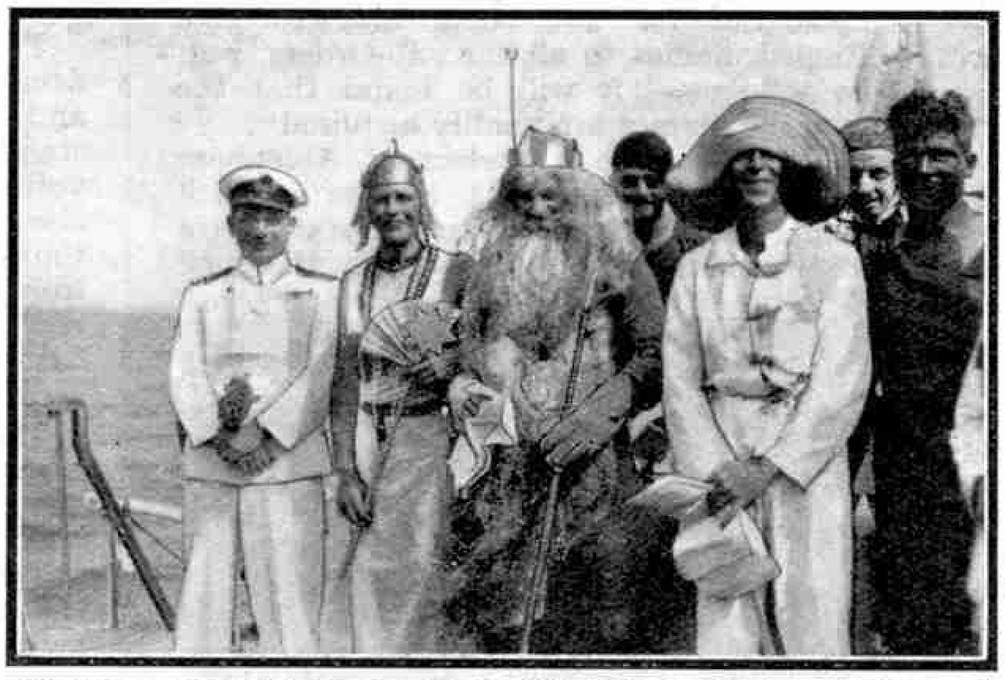
The entrance to the Rove Tunnel, the longest canal tunnel in the world. Photograph by W. E. King (London, S.W.16.)

The canal that passes through the tunnel is part of a system connecting Marseilles with Arles on the Rhone. After burrowing under the Estaque Ridge it enters a great lake known as Estang de Berre. A second canal connects this lake to the Rhone at Arles, the total length of this waterway being more than 15 miles. When the tunnel was opened in 1926, barges from the Rhine were able to reach Marseilles and the Mediterranean.

W. E. KING (London, S.W.16).

Crossing the Line

The ceremony of "Crossing the Line," in which those who have never crossed the Equator are initiated into the ranks of the old "Sea Dogs," is perhaps the most amusing and spectacular of the many customs observed at sea. It is carried out with great spirit in the Royal Navy, and the sailor exercises his proverbial handiness in making weird costumes in which to array Neptune and his court.



King Neptune and Queen Amphitrite, with their court, about to take part in initiation ceremonies on a ship "crossing the line." Photograph by E. J. Peddle (Bristol).

As eight bells are struck on the eve of crossing the line, a hail comes from the darkness of the fo'c'sle: "What ship is that and whither bound?" The Captain answers from the bridge and is ordered to stop the ship. The searchlights on the bridge are then turned on, to disclose a remarkable group assembled "forrard." The most striking figure in this group is King Neptune himself, but the clerk, policeman and bears accompanying him also are effectively portrayed.

Making his way aft, Neptune announces his intention of visiting the ship next day in order to exact homage from those who have not yet crossed the Equator. Honours are presented to old sailors who have previously crossed, and then Neptune and his court retire, with the warning that no novice is to attempt to escape the ceremony.

The fun begins at 8 o'clock next morning, when King Neptune and Queen Amphitrite make their appearance. With them is a truly regal court consisting of the Royal Jester, the Clerk of the Court, the Chief Justice and a miscellaneous crowd of doctors, barbers, nymphs, policemen and bears. Accompanied by the band, all march to the scene of operations, where a tipping chair and a huge bath stand on a temporary platform.

After the proclamation, the Royal Jester tests the water in which the newcomers are to be baptised. The first novice is then announced, examined by the court doctors, and lathered with noxious paste applied by means of a distemper brush. He is then shaved with a huge wooden razor and tipped backwards into the bath, where the waiting bears pounce on him, to the accompaniment of cheers and laughter from the onlookers.

Sometimes the proceedings are varied by accusing a victim of an imaginary crime, usually one having some humorous bearing upon his normal duty. Justice is meted out by King Neptune himself, who sentences the culprit to undergo severe and prolonged duckings. Those who attempt to shirk also are treated with severity, for the policemen round them up in order to bring them before Neptune, who pronounces Royal Watery Judgment upon them!

The time passes quickly with fun and frolic. Every man initiated receives a certificate stating that he has been duly received into the ranks of Old Mariners, and on his next crossing he will have the privilege of being a member of the court and of enjoying the fun that on this occasion others will provide for him.

E. J. PEDDLE (Bristol).

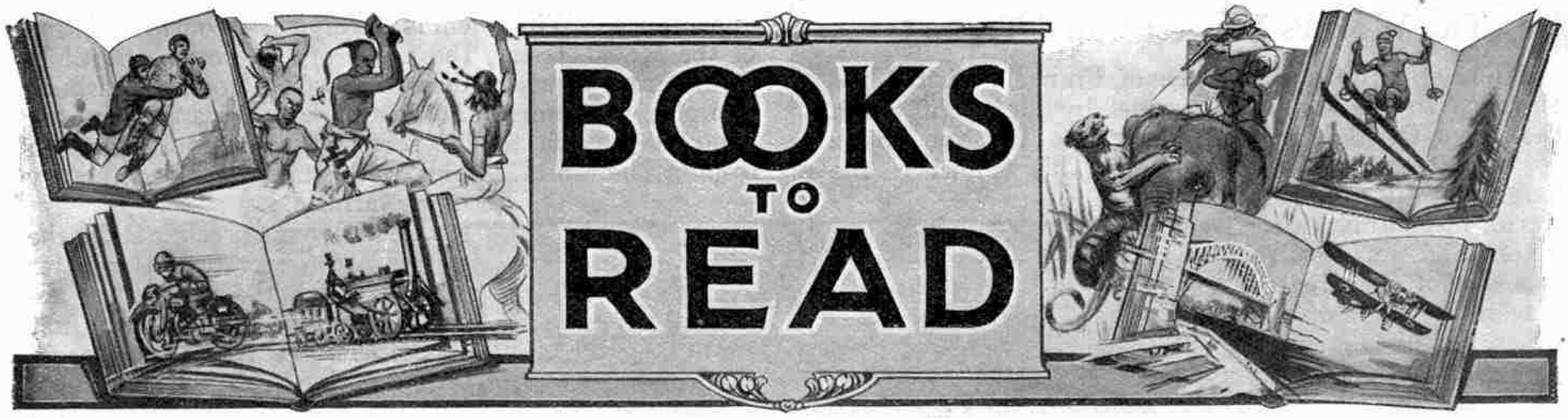
On Board a Windjammer

Recently I visited the "*Parma*" and the "*Olivebank*" while they were in dock at Hull. These vessels are four-masted iron-hulled barques, and had brought wheat from Australia. The "*Parma*" had completed the run in 83 days and was of special interest to me, for the well-known film "*Windjammer*" was taken aboard her.

The grain in the hulls of the two vessels was being unloaded by means of hydraulic winches. These were on the dock side, and their cables were passed through pulleys attached to the masts of the vessels. The sacks of grain were hoisted three at a time and lowered on to the platform of a weighing machine.

As I stood on the deck of the "*Parma*," the huge masts, made of tubular steel, towered invitingly above me, and I climbed part of the way up the foremast. Although I only went as far as the first yard, I could see Spurn Point about 20 miles away.

G. DEBEAR (Hull).



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/– for postage to the price. Postages on different books vary, but any balance remaining will be refunded.

"British Beetles"

By N. H. Joy, M.R.C.S., etc. (Warne. 5/–)

Beetles—generally regarded with horror and loathing, especially by our mothers and sisters!—are most interesting creatures and they play a very important part in Nature. Most of those who take up an open-air hobby are interested in either birds or insects. Many commence by collecting butterflies beyond which by far the greater number of us never advance, even after we have grown up. As Dr. Joy points out, practically everything is now known about the natural history of British butterflies and moths, and there is little prospect of adding new scientific facts by continuing the study of these insects. In regard to beetles, however, the position is quite different, for of the 3,630 British beetles now known, there are many about whose life histories we know nothing. Apart from this, there are many species that remain to be discovered, not only in Britain but in science generally.

Dr. Joy has written this book, on the homes and habits of our beetles, in the hope that it will create a greater interest in the subject and induce some further study with a view to filling the gaps in our knowledge. Any of our readers, therefore, who want an outdoor hobby that will not only be of interest, but also be one in which they can do useful work, should take up the study of beetles.

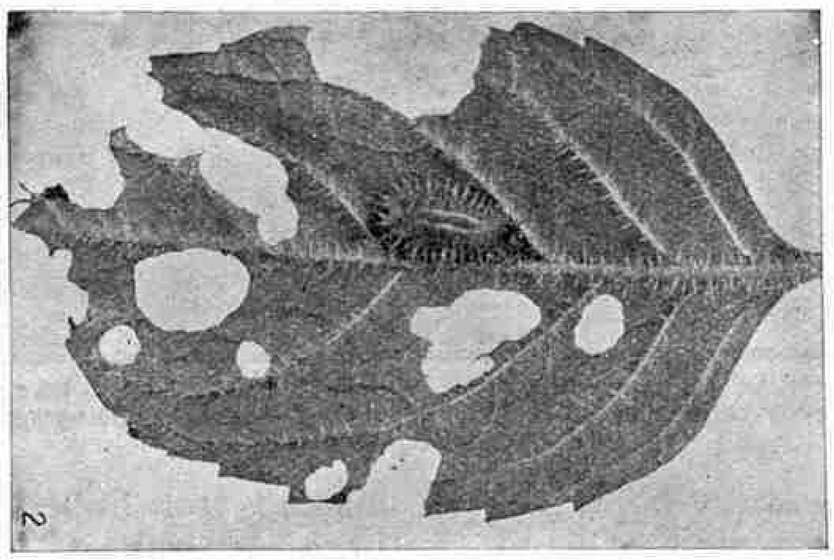
Beetles are found almost everywhere—in the garden, under stones, on the grass, and in flight on a summer's evening. Decaying vegetable matter is frequently swarming with beetle life; and flowers and hedges, and the boughs of trees all contribute their quota. Sometimes the most unlikely places are the most profitable. Dr. Joy tells how, when visiting a granary and examining some old sacks, he found a beetle that he had never seen before. The foreman pointed out where the rubbish from the floor was deposited, and on examining this it was found to be alive with beetles. No less than thirty-four different kinds, including some very rare ones, were taken at this spot.

Interesting specimens may often be taken in an ant's nest, for over forty species of British beetles associate with ants. The latter seem to take the greatest care of their guests, and will often carry them to a place of safety when disturbed. Some beetles associate with birds; others with moles. In moles' nests Dr. Joy has found several species hitherto regarded as being of the utmost rarity, including one of a large size that was new to science. Truly, beetle-hunting would seem to be a fascinating and profitable pastime!

The book is illustrated with photographs and numerous drawings showing representative species, all of which help to make identification easier. Dr. Joy apologises for not being able to give English names to all the sub-Orders, but, he tells us, "it will be found that the scientific names are readily acquired .... When I became a prefect at Aldenham School (because I was in the football team, although not up to the sixth form in work) I was let off saying the long Latin grace, because I could not be sure of remembering it! Yet I had no difficulty whatever in remembering the names of the beetles, when I started studying them seriously."



The larva of the "Burying Beetle" in its cell at the end of the burrow. (See below.)



The larva of the Mint "Tortoise Beetle" awaiting pupation. (From "British Beetles" reviewed on this page.)

"What Time Is It?"

By M. Ilin. (Routledge. 3/6)

This little book gives us a brief but comprehensive story of our clocks. Time measurement, although apparently simple, is really a rather complicated problem. It required countless centuries before Man could accurately measure the hours and minutes and in the attempt to solve the problem all kinds of things were tried. These included the Sun and the stars; sand and water; the crowing cock; oil lamps and candles; and finally, the pendulum and the spring. Apart from such devices as gnomes, klepshydras and sun-dials, there have been evolved throughout the ages clocks of all varieties and sizes, from the tiny watch that tapped the hours on the wearer's finger to famous Big Ben that broadcasts his time signals to the world. Despite the beauty of modern craftsmanship, however, there is no timepiece made that never loses or gains. The stars "are the only chronometers that never lie . . . it is only by the stars that we can correct our watches . . . we are never deceived by the silent courses of the stars, undisturbed and unchangeable."

The story is told in an attractive way, and the book is illustrated with a number of black and white sketches.

"Woodwork Design"

By E. H. Arnold. (Pitman. 6/– net)

The handicraft books published by this firm form a series of great practical value, and it is interesting to note that the standard appears to improve with each volume. "*Woodwork Design*" is a concise guide to the main factors that influence the design of furniture made by hand from hardwoods. Its chief object is to meet the needs of the wood-worker who, having mastered the elementary stages, is attempting to create something original.

The earlier sections of the book deal with the ideals aimed at in modern furniture, and the nature of the material used and its effect on design and finish. The remainder of the book, which to most readers will be the most interesting, gives examples of modern furniture design, with a photograph and a brief description in each case. These examples cannot fail to be of the greatest interest to all advanced wood-workers, who are on the look-out for new ideas.

"Hildebrand"

By John Thornburn. (Country Life Ltd. 10/6 net)

The publishers describe "*Hildebrand*" as "A book for children and for everybody who was ever a child," and it certainly merits this description. It tells in a series of stories the adventures of the horse Hildebrand from the time when he was given power of speech. Wherever Hildebrand goes, out hunting, or to the seaside, the circus, the horse show, or the polo ground, he never fails to become the centre of amusing episodes. Yet in spite of all the absurd situations and the wild hilarity one cannot help feeling that the book is true to horse life. The gaily-coloured illustrations by "Wag" catch the spirit of the book splendidly.

"See For Yourself"

By Edmund Vale. (Dent. 5/-)

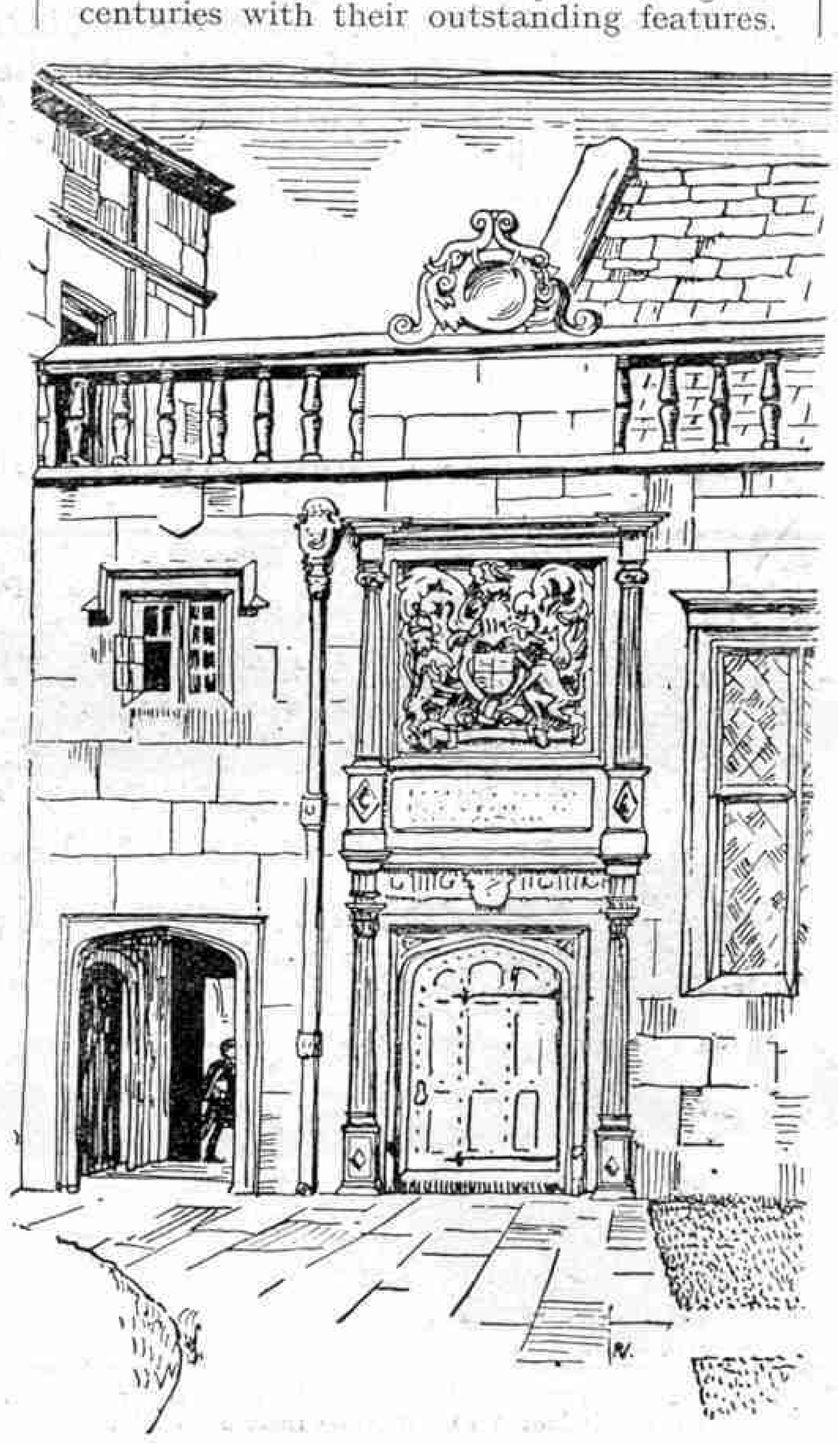
In this "manual of sight-seeing" we are shown how to enjoy one of the greatest recreations of our time. The author divides his book into two parts, and these he describes as "the reading stuff for home service, and a compendium for active service in the field." Mr. Vale—who, incidentally, is also the author of "The Track of the Royal Scot" and other books—writes in such an entertaining way that we do not realise Part I of his book is actually a sketchy survey of history from prehistoric times. But history in this form is very entertaining and loses all its terrors. We could read a great deal more were it available!

It is remarkable to learn how ancient times and modern inventions can be made to link up. For example, at first sight we do not associate aviation with archæology. The aeroplane, however, has done more than anything else to revolutionise method and thought in this science. In a few years it "has discovered in England ancient cultivation systems, roads, villages, burial places, things that centuries of English weather and generations of ploughboys have long obliterated to the earth-bound eye."

From the romantic discovery of the Piltdown skull, and of the two other skulls that have taught us so much, we pass to flint and stone weapons, to cromlechs and dolmens, and to the riddle of the stone rings found in so many parts of the country. Next we are given a rapid bird's-eye view of the Bronze and Iron Ages. We learn how to identify the different forts and earthworks of the peoples who lived in those times; and the later walls and gateways of the Romans and the roads and ruins they left behind them wherever their legions penetrated.

We pass on to the Gothic and Norman styles; the Early English, with its flying buttresses and curious mouldings; and the Perpendicular, with its ornaments and pointed windows. Then comes the Renaissance, with the romantic moats and battlements of feudal times. We are made to feel quite at home with such curious things as crockets, cusps, and foils. If hitherto we regarded "swag" as something associated only with burglars, we now learn that this is not necessarily the case, and that the word has another and more dignified meaning. There are informative chapters on seeing churches, castles, and monasteries, included in which are details of such objects as preaching crosses, sundials, spires, fonts, altar squints, and many other things of interest that the sightseer should not miss.

Part 2 of the book contains an array of clues that should enable any of us to identify on sight the period of any ruin from the Stone Age down to our own time. Here, too, we read of scripts and Roman numerals; of brickwork and masonry; and of the curious hillside figures, some of which are of unknown antiquity. On the hillside at Cerne Abbas in Dorset is the "Man of Cerne"—a giant figure brandishing a club and dating possibly from before the Bronze Age. Another similar figure is the "Long Man of Wilmington" in Sussex, dating probably from the Bronze Age. The White Horse at Uffington, Berkshire, is attributed to King Alfred, but is probably of a much earlier period. Who made these figures and why, is not known, but in connection with the White Horse there is a curious festival of rolling a cheese down the steep hillside into the field below. According to Sir Flinders Petrie, this custom has its origin in an ancient religious ceremony. The latest figure to be added to these hillside curiosities is the Lion that marks the site of the popular Zoological Park at Whipsnade, near Dunstable. Perhaps some day, ten thousand years hence, our descendants will gaze on this 1933 figure and solemnly ask themselves who made it and why! This part of the book concludes with useful lists of important dates, and an ingenious attempt to assist the memory in linking the centuries with their outstanding features.



Sherborne School. An example of Jacobean architecture. (From "See for Yourself" reviewed on this page.

Mr. Vale has managed to pack an enormous amount of useful and entertaining information into his 272 pages, and the text is enhanced by numerous and helpful drawings. It is pleasing to find an adequate index—a feature that adds greatly to the value of any book, and especially to one of this kind.

"Dreamers of Empire"

By Achmed Abdullah and T. C. Pakenham (Harrap. 7/6 net)

The ambitions that animated the great men of the world are often quite as interesting as their achievements. The five men whose life stories are told in this book of high adventure provide interesting examples of this fact. They were all men of high ideals, who saw far into the future, and throughout their lives toiled with passionate energy towards the goal on which they had set their hearts. Some of them failed during their lifetime, but the things for which they strove ultimately came to pass.

Cecil John Rhodes, who dreamed of an all-British Africa and a railway from the Cape to Cairo, forms the subject of the first of these narratives. We read of how Rhodes made a fortune at the Kimberley diamond mines, and of the great part he played in the development of the vast territory in British South Africa that is now known as Rhodesia. He was always absorbed in big schemes; little projects and the details of larger ones had small interest for him. Nothing is more typical of Rhodes than the words he whispered faintly to Jamieson just before he died: "So little done! So much to do!"

Richard Burton, the great traveller who is perhaps best remembered for his 16-volume translation of the "*Arabian Nights*," crossed Arabia on foot, explored Tanganyika with Speke, ventured alone on a mission to the king of Dahomey, and undertook other amazing journeys. He set out into the unknown in the true spirit of the discoverer, fearing nothing, and facing all difficulties with an unflinching determination to reach the point at which he aimed.

From Burton we pass on to John Nicholson, the great soldier, who in the midst of the Indian Mutiny dreamed of peace. We are told that at school "he showed no intelligence above the average, no particular distinction except a glorious temper, a strictly Irish temper—'If ye see a head hit it.'" When Delhi was attacked Nicholson led the storming party, and a thrilling account of this conflict, during which Nicholson was mortally wounded, is given in this chapter. Closely linked with the story of Nicholson is that of Sir Henry Montgomery Lawrence, the great Anglo-Indian soldier and statesman, who dreamed of justice. He is described as "the friend of everyone who is down, the generous, the loved, who got a little more for every one, who fought every losing battle for the old chiefs, with entire disregard of his own interests . . ." The authors give a stirring account of the part Lawrence played in the Mutiny, and especially of the four months' siege of Lucknow, during which he was killed.

Finally we come to General Gordon, who always dreamed of Christ. His military career was crowded with exciting incidents, and in the brief space available we are given a stirring picture of the enormous difficulties he had to surmount. Extracts from his journal give an insight into the fine character of this great man. Much has been written of Gordon's death at Khartoum, and there is now little new to be said on the subject. The splendid courage Gordon displayed to the end affords a fine example to every British boy.

The five narratives in this book will appeal to all boys who love to read stories of battles against great odds, and of hardships, dangers and privations undertaken in the cause of Empire.

New Books

The undermentioned books, recently published, will be reviewed in a future issue.

Two Thousand Years of Science
by R. J. Harvey-Gibson (Black, 12/6)

101 Things for a Boy to Make
by A. G. Horth (Batsford, 5/-)

Scale Model Aircraft
by J. H. Stevens (Hamilton, 5/-)

A Pre-History Reader
by T. F. G. Dexter (Watts, 1/6)

In Search of Wild Flowers
by J. F. Rayner (Watts, 1/6)

The Quest for Polar Treasures
by Jan Welzi (Allan & Unwin, 10/6)

Earth-Lore: Geology Without Jargon
by S. J. Shand (Murby, 5/-)

Five Plays for Scouts
by H. E. & N. J. Nicholls (Brown & Ferguson, 1/6)

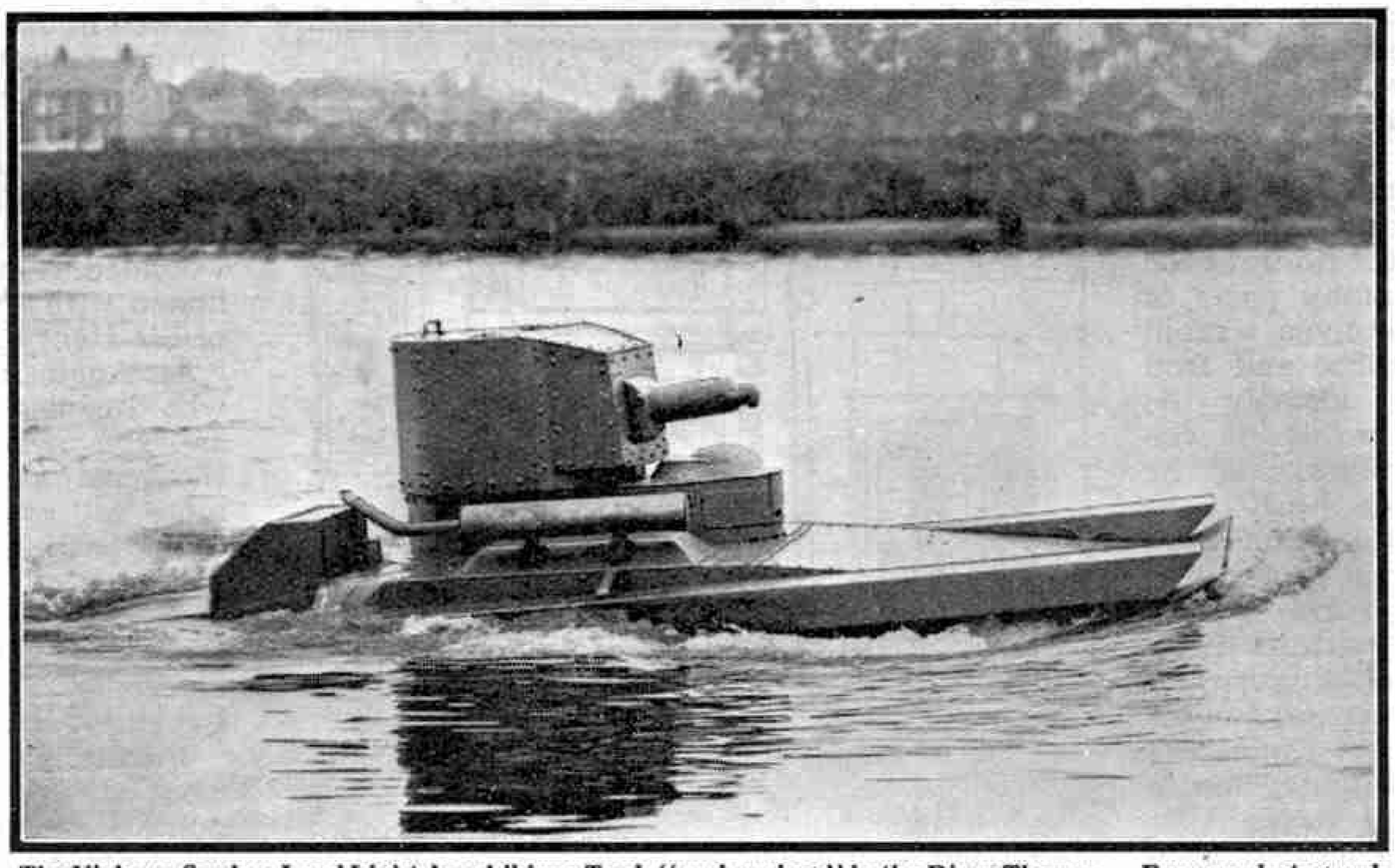
A Tank That Swims

Remarkable Amphibious War Machine

TANKS came into prominence for the first time during the Great War, but the idea of a mechanical war machine of this type can be traced as far back as the 15th century. The early tanks were more or less satisfactory from the point of view of affording protection to their occupants, but they were all extremely inefficient in means of self-propulsion, and on anything but a fairly good road they were practically helpless. The British tank, which first appeared in action in 1916, was the first machine of this type to have efficient means of propulsion and to be able to traverse rough ground.

During the Great War the opposing armies took up entrenched positions opposite to one another, and the ground between these positions and all around them was broken up by shell fire to such an extent as to be quite impracticable for ordinary vehicular traffic. The British tank provided a mechanical monster able to traverse this rough ground with little difficulty, and capable of breaking down or climbing over obstructions, and passing across trenches and shell holes. The first tanks were thoroughly effective, but they were slow, and their internal heat and the vibration when in motion was so great as seriously to exhaust the crews. Improvements in these respects were made and by the end of the War these machines had reached a remarkable state of all-round efficiency though they were still slow. New and further improved types of tank have since been developed. Prominent among these is the "*Vickers Medium*," which has a 90 h.p. air-cooled engine and a circular turret that carries one 3-pr. quick-firing gun and several light machine guns that can be fired in any direction. This machine travels from 20 to 25 m.p.h. across good country, and even over very rough land it is capable of maintaining an average of about 7 m.p.h. Its trench-crossing capacity is 6 ft., and its cruising radius, with full petrol and oil tanks, is 150 miles.

The effect of the introduction into modern armies of armoured fighting vehicles of the tank type has had a revolutionary effect on the application of tactical principles. In the future, tactical localities will be chosen with a special view to the protection they afford against attack from vehicles of this type. Of all the natural physical obstacles that it is possible to select for protection against attack by tanks, none is so effective as deep water, either sea, lake, river or canal. The ordinary type of tank is quite incapable of crossing deep water, and for this reason Vickers-Armstrongs have given a great deal of attention to the attempt to evolve a really efficient swimming tank. As the result of their efforts they have produced a vehicle that affords a complete solution to the problem of getting an armed and armoured tank across deep water, without the use of a bridge or raft, or any other outside aid. This remarkable machine is known as the Vickers-Carden-Loyd amphibious tank. It possesses all the fighting qualities of the latest type of light tank, and in addition is able to cross wide stretches of deep water as easily as it can cross the roughest country. It is primarily a tank, however, and not a boat that can go across country.



The Vickers-Carden-Loyd Light Amphibious Tank "swimming" in the River Thames. For our photograph we are indebted to Vickers-Armstrongs Ltd.

It is not difficult to imagine the decisive effect that the presence of amphibious tanks would have on operations involving disembarkation on a hostile beach. The story of the heroic but costly landings in the Gallipoli Peninsula during the Great War would certainly have been different if the troops had been provided with amphibious tanks capable of entering the water direct from the ships and swimming straight to the shore.

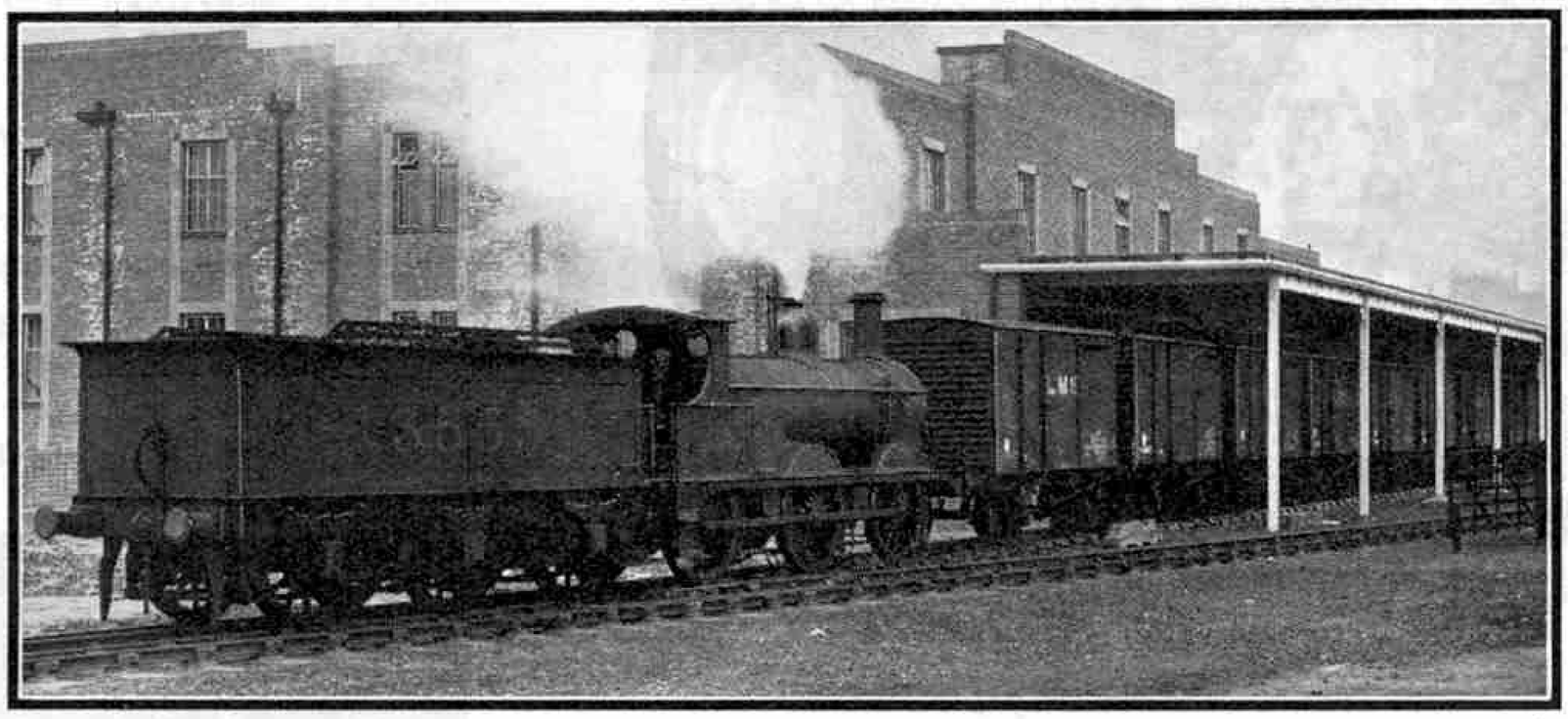
The Vickers-Carden-Loyd amphibious tank is 6 ft. 10 in. wide, 13 ft. long and 6 ft. high, and weighs 2 tons 15 cwt. Its maximum road speed is 40 m.p.h., and it is capable of climbing a continuous slope of 30 deg. at a speed of about 6 m.p.h. when fully loaded with two men, machine gun and 2,500 rounds of ammunition. In the case of short slopes the tank can easily surmount 45 deg. The cross-country capacity of the vehicle is remarkable, for it can surmount a vertical wall 1 ft. 8 in. high and cross a ditch 5 ft. wide with vertical banks. It is just as handy to manœuvre as any other of the track vehicles supplied by Vickers-Armstrongs, and it has a turning circle of only 22 ft. The armour protection consists of 9 mm. bullet-proof plate on the vertical front plates, this thickness being proof against rifle calibre ammunition at point blank range, and against armour-piercing ammunition at a range of 150 metres. The bullet-proof plate on those portions of the sides and back that are vertical is 7 mm. thick.

The tank's water speed is 6 m.p.h., and its swimming efficiency is very high. Tests made in the River Thames just above Chertsey Lock, for instance, have shown that it is capable of crossing the full width of the river across the current without any loss of direction.

Railhead Distribution of Bournville Products

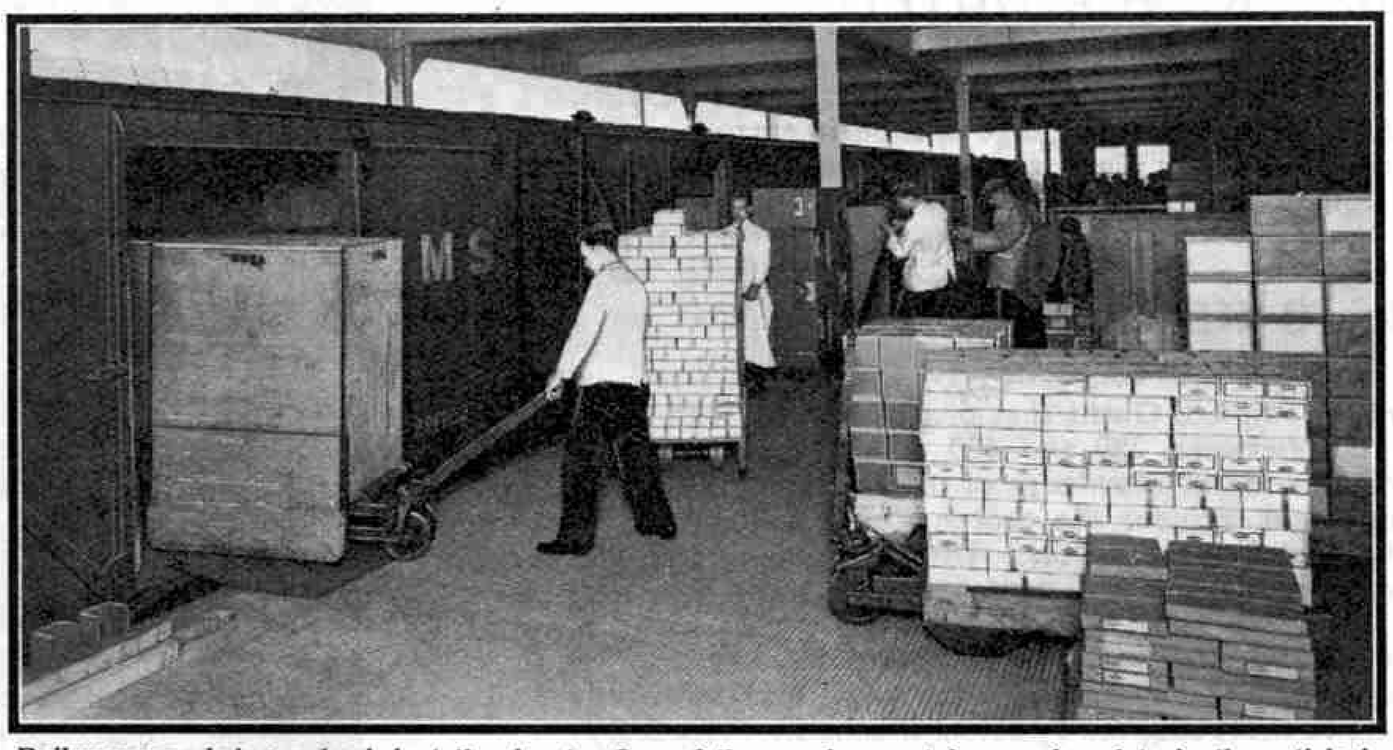
An Interesting London Depot

THE transport of foodstuffs without deterioration and with the greatest possible speed is an aspect of their business that has long concerned the railway companies. It has given rise to the series of fast freight trains composed of special brake-fitted vehicles run at practically express speeds by passenger or mixed traffic locomotives. Such trains are familiar to most "*M.M.*" readers. The vans used are specially adapted for the particular traffic they are intended to convey, for milk, fruit or frozen meat each requires its own particular treatment in order to maintain it in good condition when on the way.



The Bournville depot, showing wagons being shunted alongside the unloading platform. For the illustrations to this article we are indebted to the L.M.S.R.

After the provision of such trains it might be thought that there was little left for the railway company to do but to obtain the traffic and convey it. Unless adequate accommodation were provided at the railhead, however, all the trouble taken to ensure the actual carriage of the goods without impairing their condition would be thrown away, and therefore special warehouses and depots have been erected for the handling of particular items of traffic. Collaboration between the railway company and the trader has given results of great benefit to both, and a good example of such unified working is the depot at Finchley Road, London, on the L.M.S.R., for the accommodation of the products of Cadbury Bros. Ltd., of Bournville, which are conveyed throughout by the railway. It was found that the existing depot at Camden Goods Station would have to be supplemented, and as the result of a joint survey the site of the new warehouse at Finchley Road was selected. The existing depot at Camden had been in use for some 10 years, so that the firm and the railway had considerable experience of railhead distribution at this place. It is interesting to note that it was in fact the first Cadbury establishment for this purpose.



Railway vans being unloaded at the depot. One of the wooden containers referred to in the article is shown being drawn out of the nearest van.

The building is a two-storey structure, and is built round a steel frame with hollow floors throughout. Provision is made for the addition of a third storey if required later, and the general plan of the building may be gathered from one of the accompanying illustrations. There is approximately 46,000 sq. ft. of office and warehouse space. Small "bogies" or trucks are used to convey goods through the stockrooms, and to withstand the wear and tear of the continuous passage of their steel wheels, cast iron tracks have been provided for them. Otherwise the floors of the stockrooms have a granolithic finish. The maintenance of suitable conditions for the storage of the various products at the depot necessitates great care and constant supervision. The incoming air is drawn through a battery of steam-heated tubes and is warmed to maintain a constant temperature and regulate the humidity in the stockrooms.

An automatic pick-up system is employed for conveying invoices from the office, through the stockrooms, to the traffic office on the despatch deck; and as each load passes from the stockrooms for despatch it is run over a special weighing machine on which the weight is automatically recorded. To avoid excessive handling of numerous small packages, wooden containers are used to transport the products from Bournville to the depot. The amount of traffic passing from the factory to the depot necessitates a special train each day.

KEMEX



No. 1 KEMEX OUTFIT

130 Experiments

This Outfit contains a supply of specially selected chemicals, together with a length of Magnesium Ribbon, sufficient to perform 130 attractive and varied experiments. The apparatus provided in the Outfit includes Test Tubes and a Test Tube Holder, a Glass Funnel, Filter Papers, and Glass Delivery Tubes, with a simple and highly-efficient Spirit Lamp that makes the Outfit completely self-contained.

Price **7/6**

No. 2 KEMEX OUTFIT

250 Experiments

This Outfit includes the whole of the contents of the No. 1 Outfit, and further chemicals that increase the range of experiments up to 250. The additional apparatus includes a porcelain Evaporating Dish, Special Test Tubes to withstand high temperatures, a handsome Test Tube Stand, and the Kemex Retort Stand and Ring, with Wire Gauze.

Price **15/-**

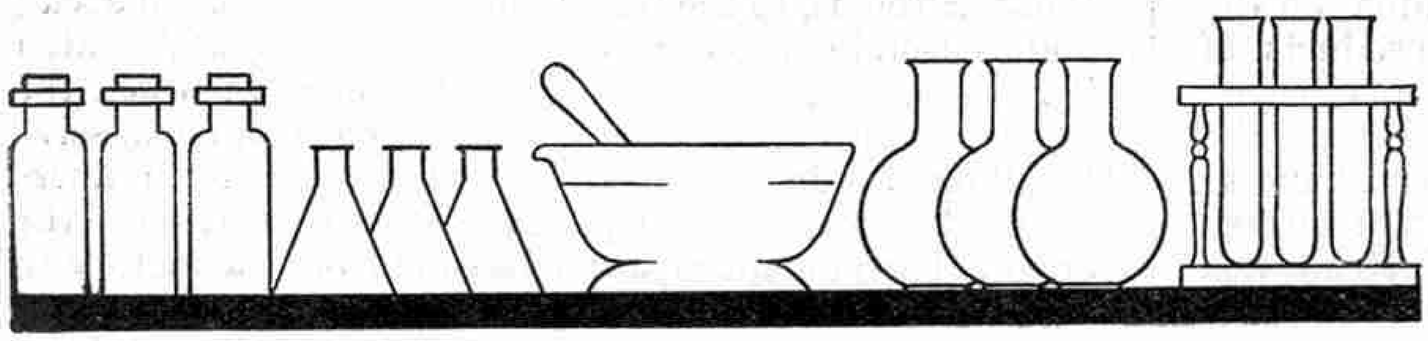
No. 3 KEMEX OUTFIT

350-400 Experiments

This is a splendid complete Outfit that provides a boy with all he requires to carry out between 350 and 400 experiments, and thus enables him to acquire a sound knowledge of the fascinating principles of chemistry. The Outfit includes the contents of the No. 2 Outfit, with additional chemicals and apparatus. The latter includes a gas-generating apparatus, consisting of a large wide-necked Flask with Thistle Funnel and Delivery Tubes. These items open up a series of experiments of outstanding interest. There is also an extension for use on the Kemex Retort Stand, to which apparatus may be readily fitted on similar lines to those adopted by actual chemists. Price **25/-**

Kemex Chemical Outfits are manufactured by

MECCANO LTD., BINNS ROAD, LIVERPOOL 13

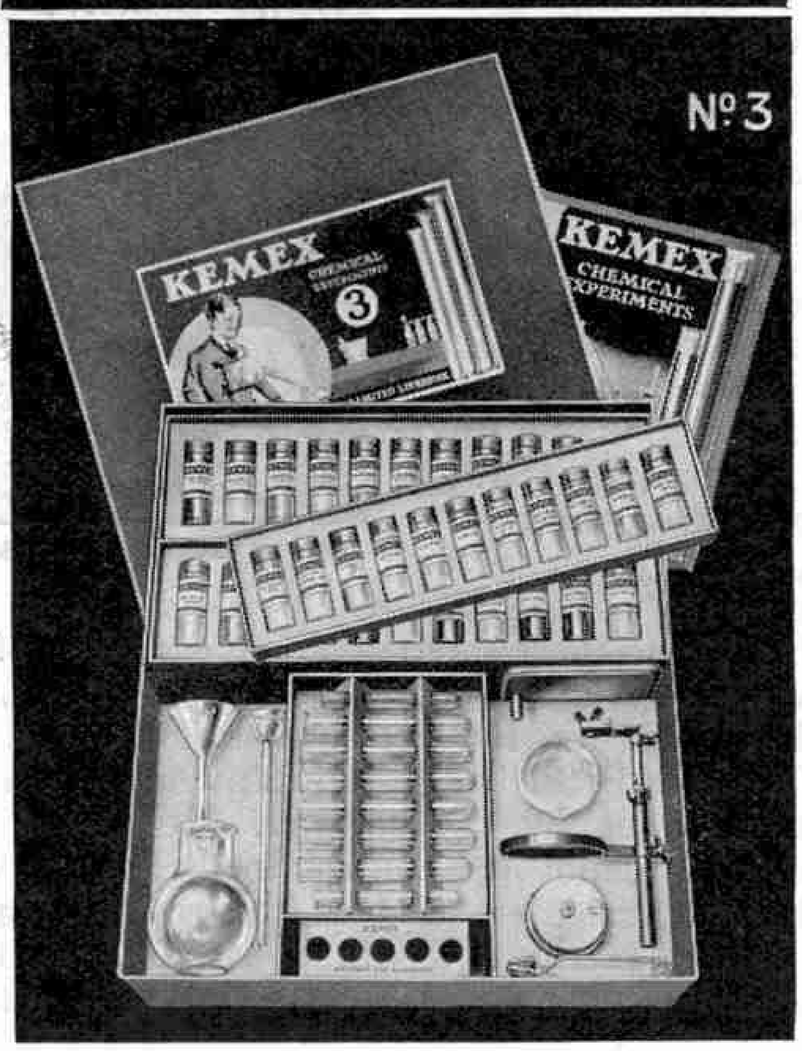


CHEMICAL EXPERIMENTS

The contents of the new Kemex Chemical Outfits will provide many hours of fascinating fun. With the apparatus and materials contained in them a boy can make dyes, inks and soaps ; test foodstuffs for impurities ; analyse air and water ; grow crystals ; write with electricity ; make invisible inks and a chemical garden ; prepare gases, and perform a host of other interesting chemical experiments.

The Outfits include everything necessary, and the hundreds of experiments that may be made are described in a simple manner in a well-illustrated Manual.







HOW THE CHEMIST HAS AIDED THE ENGINEER

ONE of the most important and useful of the many metals at the disposal of the modern engineer is aluminium. This metal and its alloys combine lightness with strength and durability, and therefore are employed in making aeroplanes and motor cars, in the building of railway rolling stock, and even in the production of kitchen utensils, for the metal does not rust, is readily cleaned, and is an excellent conductor of heat.

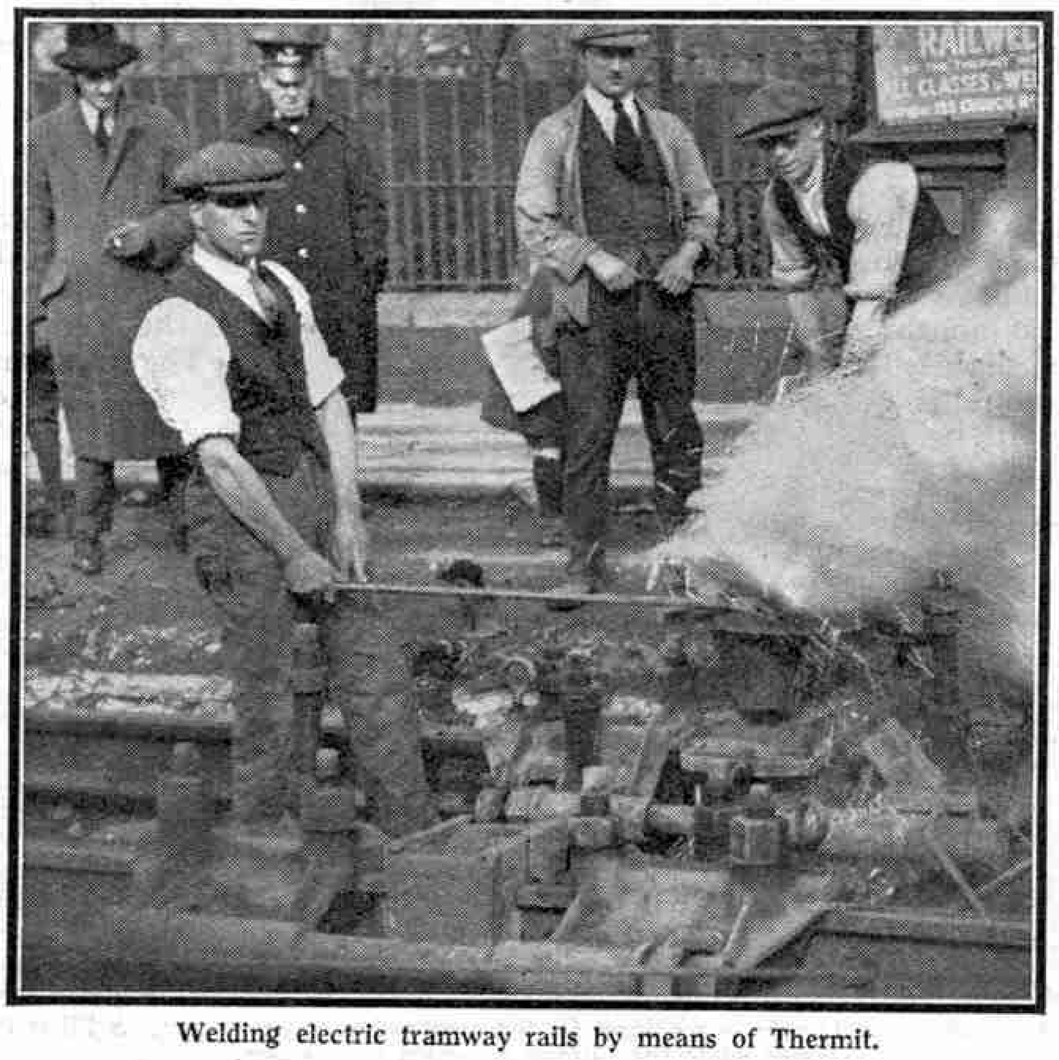
The chemist achieved one of his greatest triumphs when he made this wonderful metal available in industry. The story of the changes that led eventually to its production in large quantities really begins in the early years of the 19th century, when an uncouth young man from the west of England became lecturer in chemistry at the Royal Institution, in London. This youth was Humphry Davy, who was destined to achieve fame as one of the world's greatest chemists.

Davy was born in Penzance, Cornwall, in 1778, and even as a boy he showed remarkable interest in experiments. He spent hours in making fireworks, and in melting fragments of tin in a miniature furnace he had contrived by scooping out the interior of a turnip and placing a lighted candle in it. When he left school he was apprenticed to a surgeon, but spent more time in carrying out chemical experiments in the garret of a friend's house than in preparing medicines in the surgery. Many of these experiments ended in violent explosions, and it was confidently predicted that he would blow up the house and everything in it!



Sir Humphry Davy, 1778-1829.

Fortunately for chemistry, Davy did not persevere in his intention of becoming a surgeon, for he was offered a post in an institution founded at Bristol for the purpose of curing patients of various ills by means of gases. Davy's part was to make experiments with the gases then known in order to find how they affected human beings when inhaled. He entered upon his new duties with great zeal and energy, and experimented freely upon himself, with extraordinary results. Among the gases that he tried was nitrous oxide, or laughing gas, and amusing results followed experiments in which Davy and his friends inhaled this extraordinary gas. They breathed it from bags of silk, and must have presented a strange spectacle as they stamped, roared and laughed round the room while under its influence. Experiments with other gases were not so humorous, however, and on more than one occasion Davy narrowly escaped death through being suffocated or poisoned.



Welding electric tramway rails by means of Thermit.

The skill that Davy had shown in his experiments with gases attracted attention, and at the early age of 23 years he was appointed Assistant Lecturer at the Royal Institution, London. There he quickly lost the uncouth and irritating manners that marked him on his arrival, and his lectures on his brilliant discoveries attracted immense audiences and made chemistry fashionable. He was knighted in 1812.

Davy's connection with the story of aluminium began in 1807 when he tried to break up caustic potash by means of electricity. He first tried passing the electric current through a solution of potash in water, but the only result of this was to split the water into hydrogen and oxygen. As the water seemed to interfere with the action, he placed a piece of moist potash between a disc of platinum and a wire of the same metal in order to pass the current through it. Part of the potash then melted, and bubbles of gas were produced round the wire, which was the positive pole, while shining metallic globules made their appearance on the platinum disc.

Davy was startled to find that these globules exploded with a brilliant flame almost as soon as they were formed. He tried scraping them into water in order to prevent this, but the action only became more violent. At length he discovered that the globules remained unchanged if they were plunged immediately into naphtha, and he was then able to examine the new substance, to which he gave the name of potassium.

Potassium was a great problem to the chemists of Davy's day, for although it looked like a metal, it was so soft that it could be cut easily with a knife, and so light that it floated on water. Metals, with the exception of quicksilver, had always been thought of as hard, dense solids, and the name was at first denied to the new substance. Eventually it was recognised that even a metal could be light, however, and potassium was acknowledged as a member of this class of elements.

Davy discovered a similar metal in caustic soda, and to this he gave the name sodium. His discoveries aroused so much interest throughout Europe that he was awarded a special prize, instituted by Napoleon I, for his brilliant experiments, although France and England were then at war!

The discovery of these strange new metals spurred Davy on to further efforts. Among other substances that he tried to decompose electrically was alumina, an earthy substance obtained from alum. He was unsuccessful, but his belief that it contained an unknown metal was confirmed in 1827, when Frederick Wöhler, a famous German chemist, obtained a grey powder from a compound of alumina by heating it with potassium, the metal that Davy had discovered. This grey powder was the only form of aluminium known for 18 years, when the first globules of metallic aluminium were separated.

The metal remained rare until Deville, a French chemist, remembered Davy's experiments, and tried to produce (*Cont'd on page 794*)

Chemical Magic at Home

LAST month we explained how to commence experiments with the Kemex Outfits, and described the best way to use the apparatus and chemicals in order to obtain successful results and the greatest possible fun. This month we turn to actual chemical operations.

Every amateur chemist should be able to prepare solutions of chemicals in water quickly and easily, for very many experiments are carried out with chemicals in this form, and in certain cases the presence of water is necessary to bring about the desired change. The preparation of a solution seems a simple matter, but if the process is not carried out in the proper manner the results may be unsatisfactory, and therefore it is advisable to follow a regular plan. First of all it should be borne in mind that strong solutions are very seldom required, and for this reason it is best to begin by adding one measure of the chemical to one-third of a Test Tube full of water. Some chemicals dissolve quickly, but with others it is necessary to hasten the process a little in order to save time. This can be done most simply by closing the mouth of the Test Tube with the thumb, and turning the Tube upside-down a few times. It is not necessary to be violent in this shaking operation, for all that is required is to provide the water with every possible opportunity of coming in contact with the substance that is intended to be dissolved.

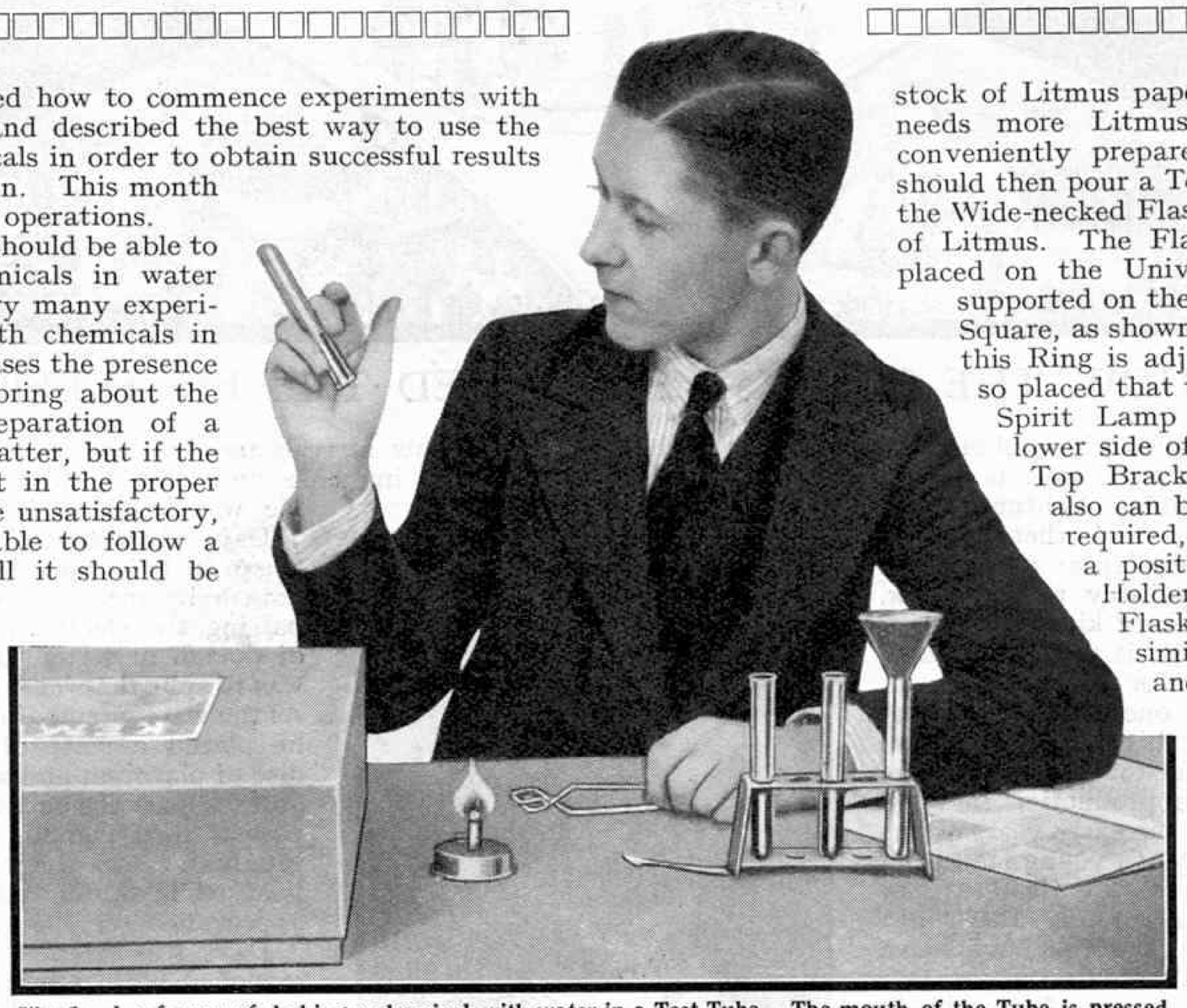


Fig. 1. A safe way of shaking a chemical with water in a Test Tube. The mouth of the Tube is pressed firmly into the ball of the thumb.

An experimenter whose thumb is too small to cover the mouth of a Test Tube tightly, or who for any other reason finds difficulty in adopting this method, should try the plan shown in Fig. 1. The Tube is held between the second and third fingers, with its open end pressed firmly against the ball of the thumb. In this position the Tube can be held easily and comfortably for as long as may be necessary, and inverted as often as required without any risk of spilling its contents.

Another method of speeding up the process of solution is that of heating the liquid, for the majority of chemicals dissolve more readily in hot water than in cold. For this purpose the Test Tube is held by means of the Test Tube Holder, with its lower end above the flame of the Spirit Lamp, as explained last month. Care should be taken to slope the Tube slightly in order that only the part containing liquid is actually above the flame, or in contact with it, for breakage may result if the glass is heated at the surface level of the solution, or above it. Vigorous heating is not required, for warming, combined with gentle shaking, will bring about the desired result. Needless to say, a hot liquid must not be shaken by closing the Tube containing it with the thumb and turning it upside down.

If the chemical concerned is in the form of lumps or large crystals, these should be crushed before being added to the water, for they will then dissolve much more rapidly.

When a comparatively large quantity of a solution is required, the Evaporating Dish or the Wide-necked Flask should be brought into use. For instance, the experimenter may desire to prepare a stock of Litmus papers, for which purpose he needs more Litmus solution than can be conveniently prepared in a Test Tube. He should then pour a Test Tube full of water into the Wide-necked Flask and add three measures of Litmus. The Flask is shaken gently and placed on the Universal Stand, where it is supported on the Ring carrying the Gauze Square, as shown in Fig. 2. The height of this Ring is adjustable, and it should be so placed that the tip of the flame of the Spirit Lamp is in contact with the lower side of the Gauze Square. The Top Bracket and Pillar Extension also can be moved up and down as required, and must be fixed in such a position that the Test Tube Holder grips the neck of the Flask. In making these and similar adjustments, flasks and other apparatus must be removed from the Stand in order to avoid the risk of breaking them.

It is interesting to note that the first effect of heating the Flask is to cover its outer surface with a film of moisture. This moisture is formed by the condensation of steam produced by the burning of alcohol in the Spirit Lamp, and it makes its appearance because the vapours rising from the Lamp are chilled by the cold Flask. As the water in the Flask becomes warm, the film disappears and the Litmus dissolves. The heating is continued until a good deep colour is obtained, but boiling should be avoided, for this causes froth and the formation of a scum. It is a general rule in chemical experiments to apply no more heat than is necessary to bring about the desired result.

A solution of Logwood is prepared in exactly the same manner as one of Litmus. In this case there is a rather surprising change of colour, for the sandy powder yields a red liquid. What happens is that the water extracts the colouring matter from the Logwood, which is obtained from a tree that grows chiefly in the West Indies. Boiling chips of the wood with water leads to the solution of the red dye, and this is more easily extracted from the powdered material included in the Kemex Outfits.

The solutions of Litmus and Logwood obtained in this manner cannot be used immediately, for they contain sediments that might interfere with the colour changes to be looked for when using them as indicators, or chemical detectives. These sediments can readily be removed by filtering, a standard chemical operation that is often required. This is carried out by pouring the liquid through a Filter Paper folded into the shape of a cone and fitted into the Funnel, as explained in the Kemex Manuals. The liquid itself passes readily through the pores of the special paper employed, but the sediment is unable to do so, and is retained.

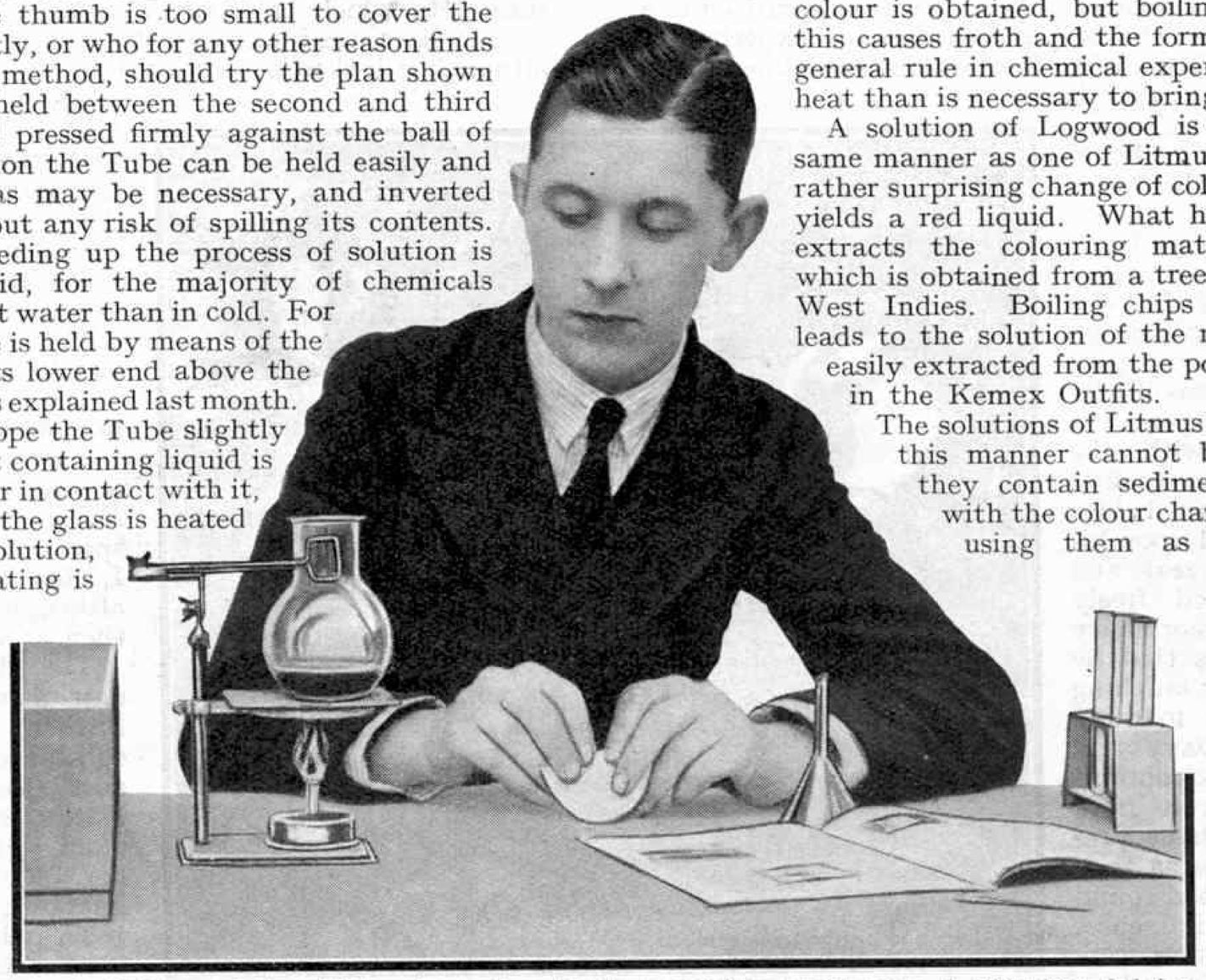


Fig. 2. Making a solution of Litmus in readiness for the preparation of test papers. A Filter Paper is being folded while the Litmus is heated with water.

One or two simple precautions are necessary to ensure quick and easy filtration. For instance, the Filter Paper must fit closely to the sides of the Funnel. When the cone has been placed

in position, therefore, it is filled with water and pressed gently downward with the tips of the fingers as soon as it is thoroughly wet. When this is done properly, the Filter Paper will not fall out when the Funnel is held upside down but will adhere to the sides of the Funnel, and is then ready for filtering.

A liquid containing solid material from which it is to be separated by filtration should not be poured quickly into the Funnel, for it will then carry with it a considerable amount of sediment, which is likely to clog the pores of the Filter Paper and make the action slow, or even bring it to a standstill. Instead, the solid matter should be allowed to settle, and as far as possible the clear liquid only poured off through the Filter Paper. In this process the Glass Rod can be used with advantage. It is held to the lip of the Flask or Evaporating Dish, as shown in Fig. 3, and the solution then flows steadily down it into the Filter Paper without splashing, or what is quite as undesirable, running back under the lip of the vessel from which it is poured.

Very often the drops of liquid that first pass through the Filter Paper carry with them a little of the unwanted solid residue. In that case a clean Test Tube should be substituted for the one below the Funnel, and the liquid already collected should be poured a second time through the Paper.

If the solid material is required for other experiments, it should be poured into the Filter Paper with the last portion of the liquid. The containing vessel should then be rinsed out with a little water, which is poured into the Funnel to ensure that the whole of the solid material that remains in the vessel is transferred to the Filter Paper.

An interesting feature of the Kemex Funnel is the presence of three tiny ridges where the stem joins the upper part. These ridges rest on the edge of the Test Tube in which the Funnel is supported, and thus leave openings through which the air inside the Tube can escape as liquid flows into it. A plain funnel that fits tightly over the mouth of a test tube, and thus prevents the air from escaping, always filters very slowly, for the pressure of the air below the funnel gradually increases and in this manner opposes the passage of the solution through the filter paper.

Chemicals in solution are recovered by evaporation, and chemists are continually evaporating liquids to dryness for this purpose. Sometimes only sufficient water is driven off to allow crystals to be formed on cooling. As pointed out in the Kemex Manuals, there is a limit to the amount of any chemical that can be dissolved in a certain quantity of water. When some of the water of a solution is driven off by evaporation, the remaining water is unable to hold the whole of the chemical in solution, and therefore some of this separates out in the form of crystals. It is usually necessary to cool the solution in order to obtain the crystals, for most chemicals are more soluble in hot water than in cold.

A good example of a chemical from which crystals can be obtained in this manner is Cobalt Chloride. A solution is prepared by dissolving four measures of the chemical in half a Test Tube full of water. This solution is poured into the Evaporating Dish, which is placed on the Wire Gauze of the Evaporating Stand with the lighted Spirit Lamp underneath it, as shown in Fig. 4.

The liquid soon reaches boiling point and steam is given off freely. Eventually the liquid will have in it more Cobalt Chloride than the remaining water can hold in solution when cold. Finding this point is not a matter of guesswork. At intervals the Spirit Lamp is removed and part of the solution poured into a clean Test Tube, which is cooled by dipping its lower end into water, or holding it under a tap. There is no danger of breaking the Tube if the cooling water is in contact only with the part containing the liquid, and the Tube itself is gently shaken.

If the solution is ready for crystallisation, small red crystals will be seen in the test portion, but if this remains perfectly clear when thoroughly cooled, it is poured back into the Dish and the evaporation continued until a similar trial shows that the solution is ready for crystallisation. Slow cooling in the Evaporating Dish, or a small saucer, then gives well-formed crystals.

Before allowing the crystals to separate, a very spectacular experiment can be carried out. In this the solution is evaporated very nearly to dryness, when the pink solution becomes blue in colour, and on driving off the water in the form of steam a blue residue is left. In spite of its different colour, this residue is Cobalt Chloride and the pink solution is reformed when water is added. This should only be done after allowing the Evaporating Dish and its contents to cool. The solution can then be evaporated to crystallising point, in the manner already explained.

Other chemicals from which crystals may be obtained are Potassium Nitrate, Copper Sulphate, Lead Nitrate, and Nickel Ammonium Sulphate. If the crystals obtained are not large enough to enable their shape to be readily distinguished, allow them to remain in the solution, for then they grow as the liquid slowly evaporates.

Very attractive experiments in crystallisation may be made with mixtures of two chemicals. For instance, mix together three measures each of Potassium Nitrate and Copper Sulphate, the crystals of which are colourless and blue respectively. Dissolve these quantities in about half a Test Tube full of water and evaporate the blue solution obtained until crystallising point is reached. Remove the crystals that separate out, dry them with clean blotting paper, add two or three drops of cold water and pour off the liquid. It will then be seen that they are almost colourless, showing that they consist chiefly of Potassium Nitrate. By dissolving them in warm water and again evaporating until crystallising point is reached, colourless crystals are obtained, the whole of the Copper Sulphate having been separated from the Potassium Nitrate.

The separation of the two simple chemicals by this method is called fractional crystallisation, the more soluble chemical separating out first.

The Copper Sulphate may be recovered by crystallising the liquid remaining after the Potassium Nitrate has been separated. It is difficult to separate two chemicals completely by this method, however, and for this reason the crystals obtained in this experiment should not be returned to their containers. They can be dried and retained, but if so must be carefully labelled in order to distinguish them from the pure chemicals provided in the Kemex Outfits.

Unlimited fun can be obtained by using crystals in "growing" plants in chemical gardens, in which they give rise to formations of quite remarkable beauty, and of the most brilliant colour. The manner in which these fascinating growths are produced and developed will be fully explained in the course of an interesting article in next month's "*M.M.*"

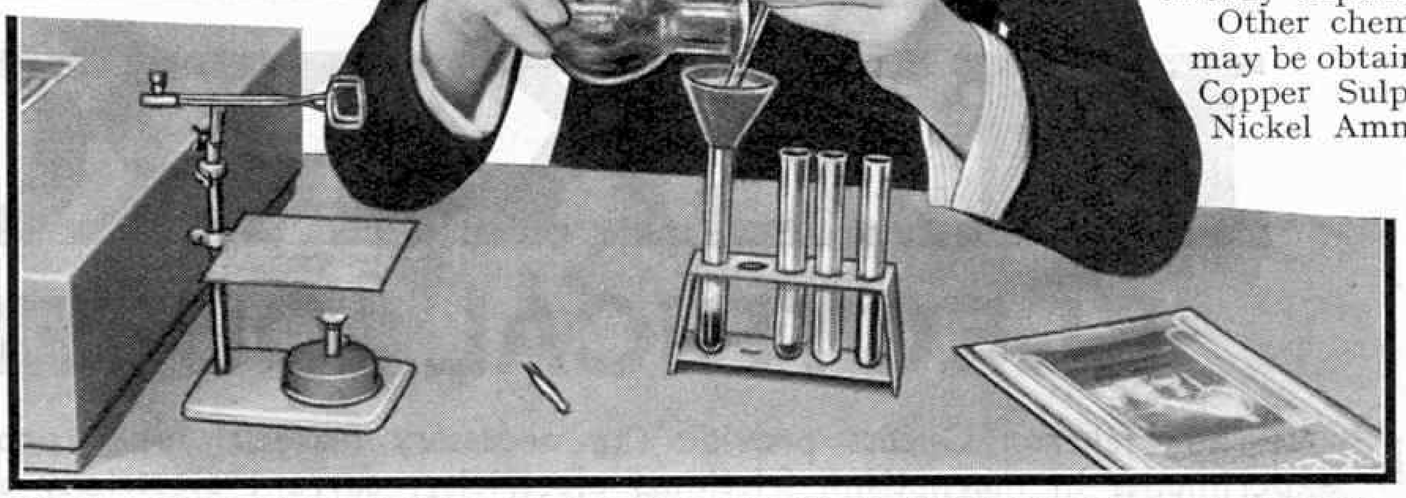


Fig. 3. Filtering Litmus solution to remove undissolved sediment. The liquid is being poured down the Glass Rod in order to avoid splashing.

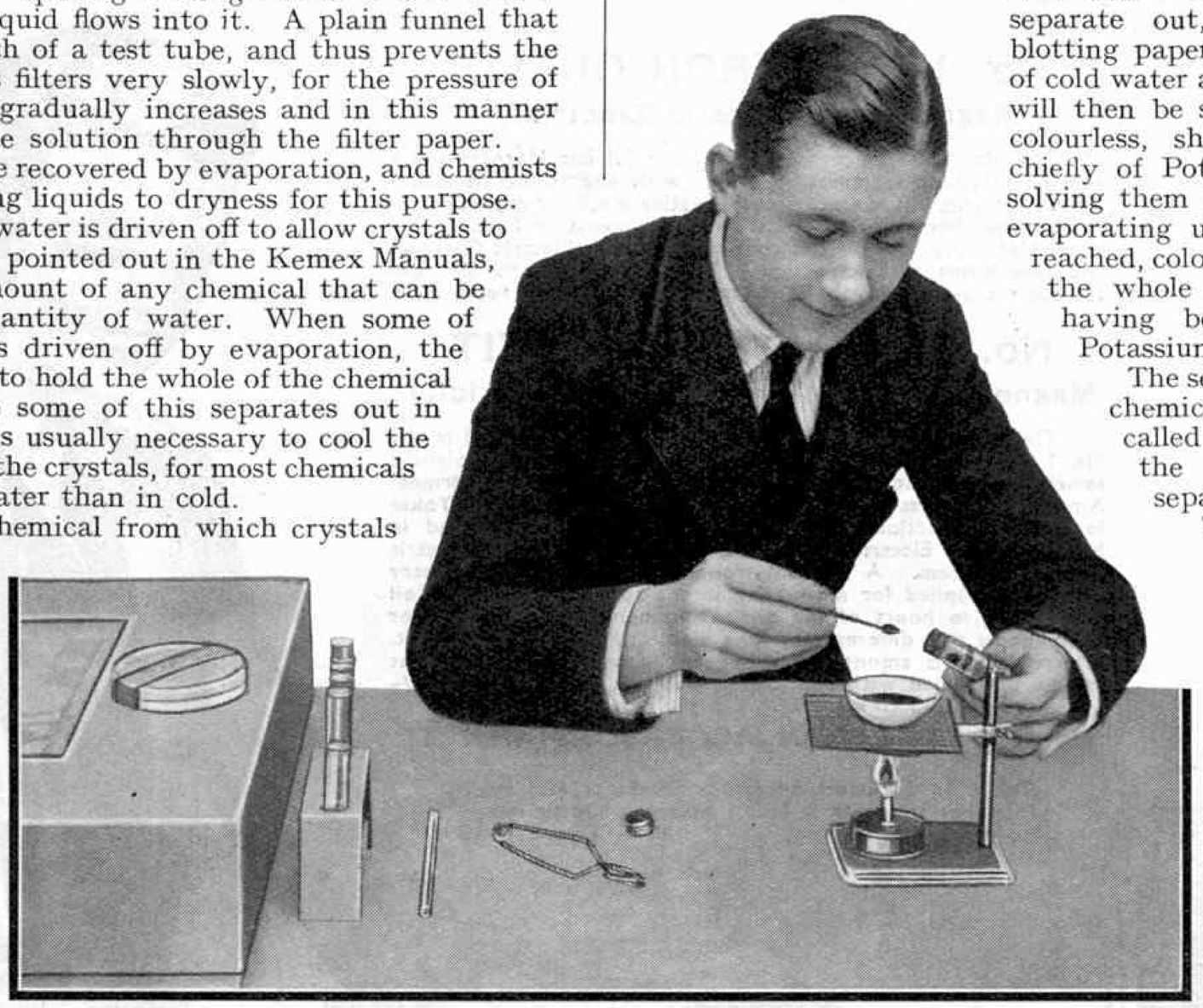
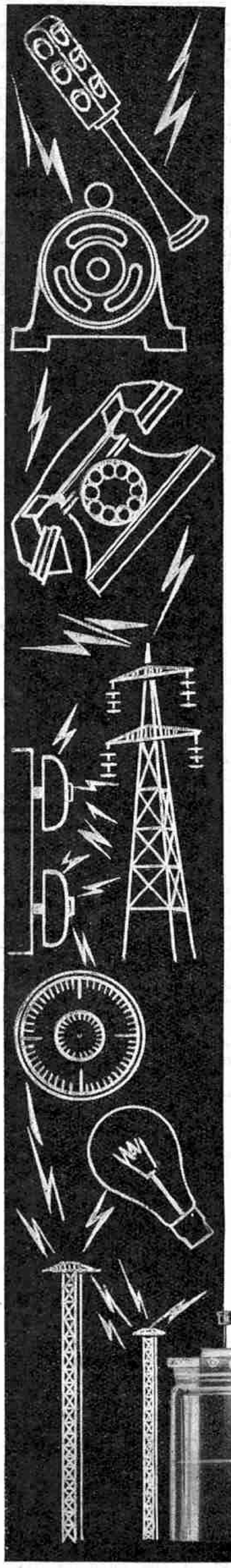


Fig. 4. Stages in making crystals. The chemical is being dissolved before evaporation to crystallising point.







ELEKTRON

ELECTRICAL OUTFITS

The Elektron Outfits provide the necessary material for a progressive series of experiments in magnetism, frictional electricity, current electricity and electroplating. They contain the parts required to construct a Reading Lamp, Electro-magnets, an Electric Bell, an Electric Telegraph, a Shocking Coil and Electric Motors, all of which may be worked from a Bichromate Cell built up from materials included in the Outfit.

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No. 2 ELEKTRON OUTFIT

Magnetism, Static and Current Electricity

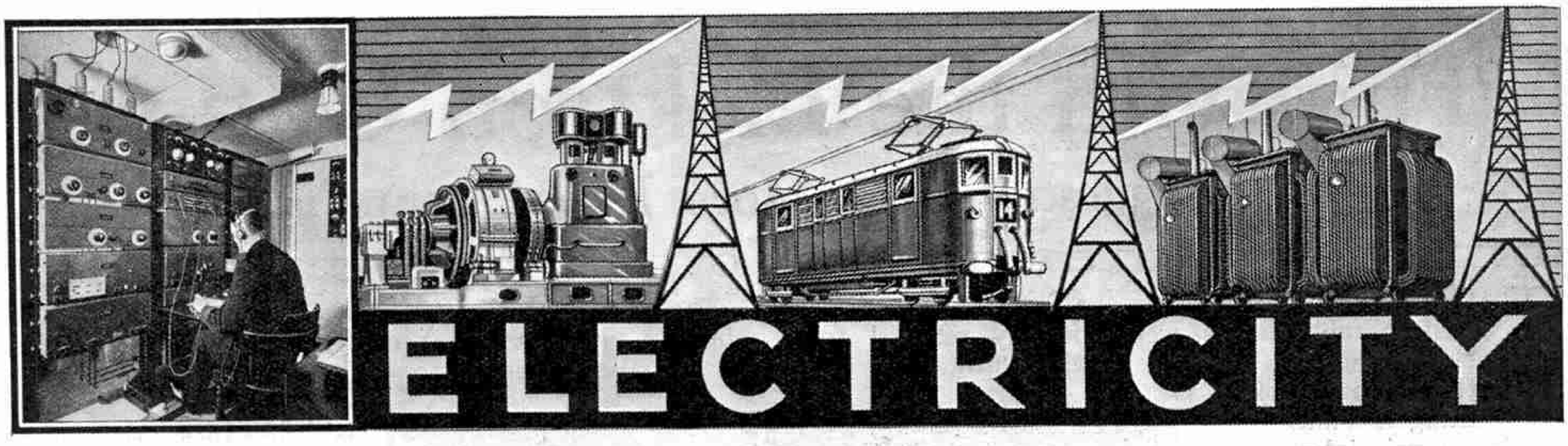
The No. 2 Elektron Outfit contains all that is included in the No. 1 Elektron Outfit, with additional parts that enable a splendid series of experiments in current electricity to be performed. Among these parts are a Horseshoe Magnet, and Coils and Yokes for the construction of Electro-Magnets that may be used in building a real Electric Bell, and a Buzzer for use in an electric telegraph system. A specially-wound coil and other necessary parts are supplied for assembling into a splendid Shocking Coil that will give hours of fun and excitement; and from other components two different working Electric Motors may be built. Electroplating is among the other fascinating experiments that can be performed with this Outfit. Price **25/-**

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A No. 1a Elektron Accessory Outfit is also available that converts a No. 1 Elektron Outfit into a No. 2. Price **16/6**



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BENJAMIN FRANKLIN'S FAMOUS EXPERIMENT

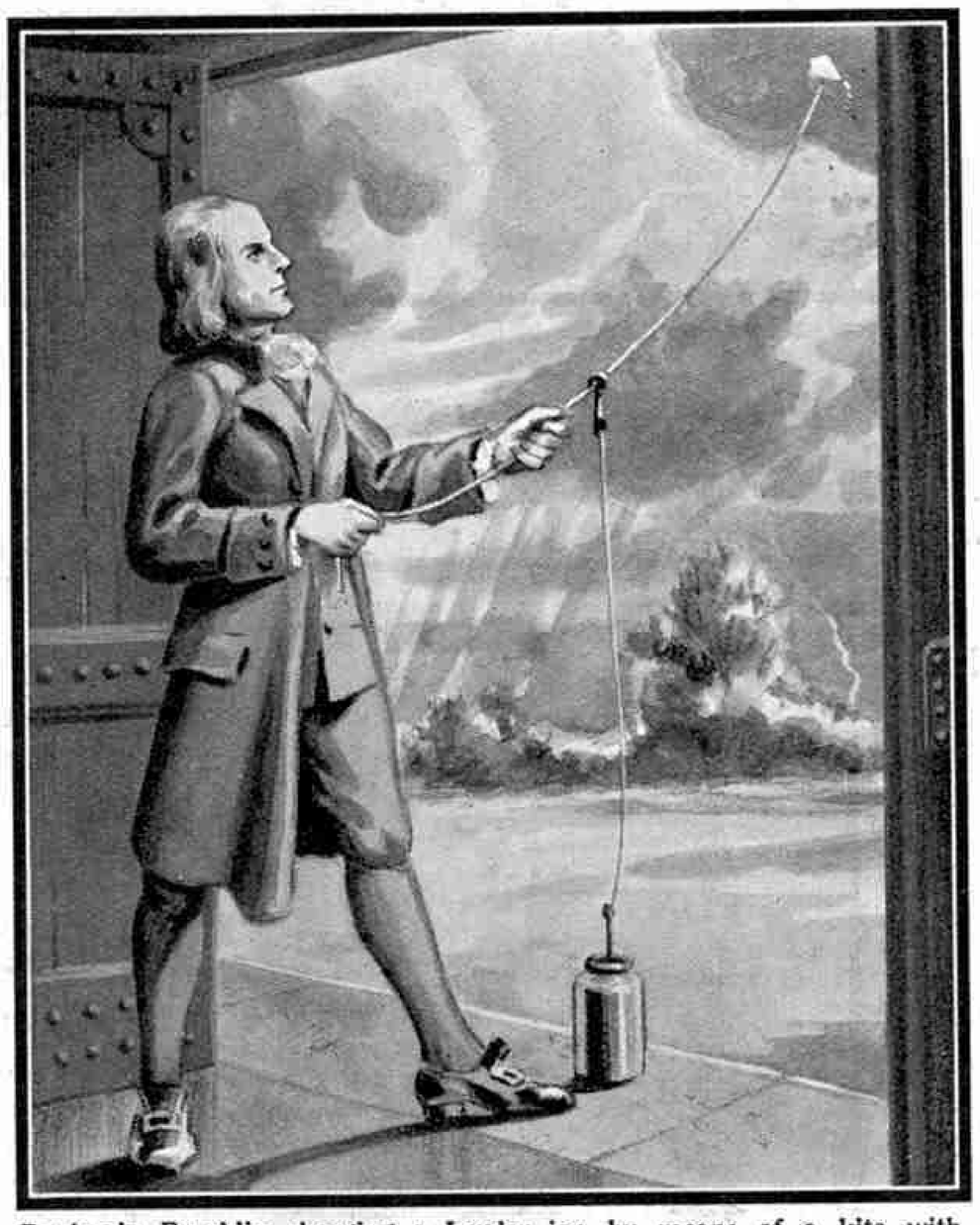
NO sight is more awe-inspiring than a violent thunderstorm, especially at night, when lightning flashes vividly across the sky, accompanied by the crash and roar of thunder. It is not surprising, therefore, that for many centuries thunderstorms were regarded with fear, especially in tropical countries, where such storms are not only more frequent, but also much more violent than in temperate climates. To-day everybody knows that lightning is an electrical discharge on an enormous scale, but it is not yet 200 years since this was first proved by Benjamin Franklin, one of the heroes of scientific discovery.

As was the case with many pioneers of science, Benjamin Franklin's career was a romance. Franklin was born in 1706 at Boston in the United States, where his father was a soap boiler and candle-maker, and as a boy he was often set to the tiresome labour of cutting wicks and filling the moulds in which the candles were made. Even at that time he showed signs of originality. He read with the greatest eagerness every book that came his way, and thus he acquired a remarkable stock of knowledge on many curious subjects. This was amusingly illustrated by an accident that had unfortunate results for Franklin himself. It is said that on one occasion he announced that he had swallowed some "acephalous molluscs." In great alarm his parents seized him, compelled him to drink a large quantity of hot water, and held him upside down in order to allow the supposed poison to run out. At length the boy recovered sufficient breath to explain that the "acephalous molluscs" were only oysters, and his indignant father immediately rewarded him with a sound thrashing!

Franklin's love of reading led to his being apprenticed to an elder half-brother who was a printer, and for five years he continued in this employment. He was harshly treated by his master, however, and at length determined to leave him and try his fortune elsewhere. He left Boston and made his way to Philadelphia, 400 miles away, arriving there dusty and travel-stained, with four shillings in his pocket. He obtained work, and his unusual abilities soon attracted the attention of influential people in Philadelphia, among them Sir William Keith, then Governor of Pennsylvania, at whose suggestion he determined to commence business on his own account. He sailed to England in order to purchase better presses and types than he could then obtain in America, but unfortunately the support promised him by Sir William Keith failed, and Franklin found himself stranded in London. He was by no means dismayed, however, and quickly found work as a compositor. Eventually he returned to America, and on his arrival in Philadelphia started in business for himself as a printer, as he had originally planned.

Franklin was hard-working, thrifty and enterprising, and he soon established a great reputation as a business man. Among other enterprises he commenced the publication of a weekly newspaper, and gradually began to take a prominent part in public life. He became Postmaster of Pennsylvania and a member of the Assembly, and when trouble broke out between England and the American colonies he was one of those who signed the Declaration of Independence that led to the foundation of the United States. He visited Europe on many important diplomatic missions, and was able to boast that he had stood as an ambassador before five kings. He died in 1790 at the age of 84.

It is remarkable that such a busy man as Franklin should have found time for scientific experiments in addition to his many business and public activities. His attention was first drawn to electricity in 1747, as the result of watching a series of experiments. He was strongly attracted by this glimpse of science, and immediately repeated the experiments for himself. Soon afterwards he began to take a great interest in thunderstorms, and before long he became convinced that these were electrical in character, and that lightning was a natural electrical discharge of exactly the same kind as the spark that could be obtained from electrical machines, and from the Leyden jar, then newly discovered. He put forward his idea in a paper that he submitted to the Royal Society of London, but it was not thought sufficiently important to be published. He was not dismayed by this rebuff, however, but continued his experiments in order to verify his belief that electricity and lightning were identical. Finally he devised a plan for drawing lightning from the clouds in such a manner that no doubt would remain of its electrical nature.



Benjamin Franklin charging a Leyden jar, by means of a kite, with electricity collected from the clouds during a thunderstorm.

For this purpose Franklin proposed to use a large kite made of silk, flown at the end of a hempen string connected to the knob of a Leyden jar; and having completed his preparations he waited impatiently for the next thunderstorm. He then flew his kite with an ordinary latch key attached to the string, as shown in our illustration. He held the key by means of a silk thread that served as an insulator, and on touching the key with his knuckle he felt a distinct shock, the electricity from the clouds having reached the key by passing down the hempen cord. To his great delight the Leyden jar became charged in exactly the same manner as if it had been connected to an electrical machine.

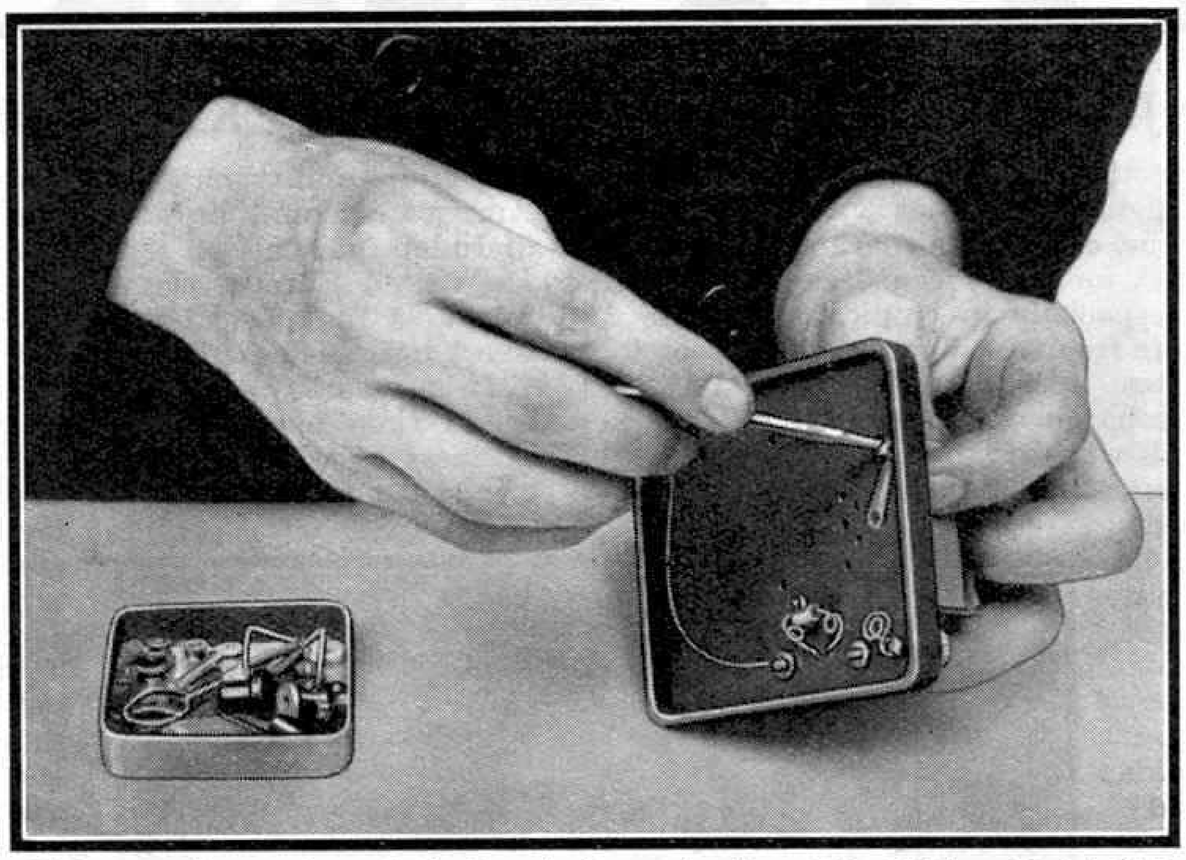
Franklin did not rest content with this discovery, but applied the knowledge he had gained to the protection of buildings from lightning. He realised that iron rods projecting above the roofs of buildings, and with their lower ends deep in the ground, would collect electricity from the clouds in the same manner as his kite, and conducted it harmlessly to earth so that the building would not be damaged. Thus he came to invent the lightning conductor, which is now used for the protection of all prominent buildings. It is interesting to learn that St. Paul's Cathedral was one of the first buildings to be protected in this manner.

Franklin was elected a Fellow of the Royal Society that previously had ignored his paper suggesting that lightning and electricity were identical, and degrees were conferred on him by the Universities of Oxford and Edinburgh in recognition of his pioneer electrical experiments.

Fun with the Elektron Outfits

Suggestions for More Experiments

THE experiments described in the Elektron Electrical Instruction Manuals were specially selected to show how the contents of the Outfits can be used to demonstrate in a fascinating manner the main principles of electricity. Any boy who carries out these experiments according to the instructions cannot fail to acquire a great deal of electrical knowledge that is of special value because it is practical. Far more can be learned by performing a series of simple experiments than by merely reading about them in a book. The selected experiments do not by any means exhaust the possibilities of the Elektron Outfits, however, for they can be extended in many directions so as to provide hours of fun for the long winter evenings. In this article we shall make a few suggestions for extending the experiments in this manner.



Wiring operations underneath the base in the construction of the Elektron Electric Bell.

Among the most interesting experiments that can be carried out with the Elektron Outfit No. 1 are those in making magnetic maps. Three such maps are illustrated on pages six and seven of the Instruction Manual, but these form only a small proportion of the maps that can be produced. For instance, two Bar Magnets placed parallel to each other give very interesting patterns. They may be arranged with their north poles pointing in the same or in opposite directions, and it is interesting to trace the directions of the lines of force between their poles. The poles of the two Magnets arranged in this manner should be at a distance of about 2 in. from each other.

A specially interesting map is produced when two Bar Magnets are placed at right angles to each other, with the line joining the poles of one of them pointing to the middle of the other, and about 2 in. away. It is fascinating to follow the curious curves and twists of the lines of force that result from the attractions and repulsions of the three poles concerned, and to see how these are exactly reversed when one of the two magnets is turned round end for end.



Another stage in building the Bell, showing the complete electro-magnet being placed in position.

The introduction of the Horseshoe Magnet, with its opposite poles near each other, gives rise to patterns of special interest. One or both Bar Magnets may be placed in various positions near the poles of the Horseshoe Magnet, and there is practically no limit to the different arrangements that can be made. For instance, a Bar Magnet may be placed parallel to the lines joining the poles of the Horseshoe Magnet, and the map obtained from it compared and contrasted with those obtained by reversing first the Bar Magnet and then the Horseshoe Magnet. This is a practice that should be followed with any interesting combinations of magnets, for the reversal of polarity brings about changes in the arrangement of the lines of force that in some cases are almost startling.

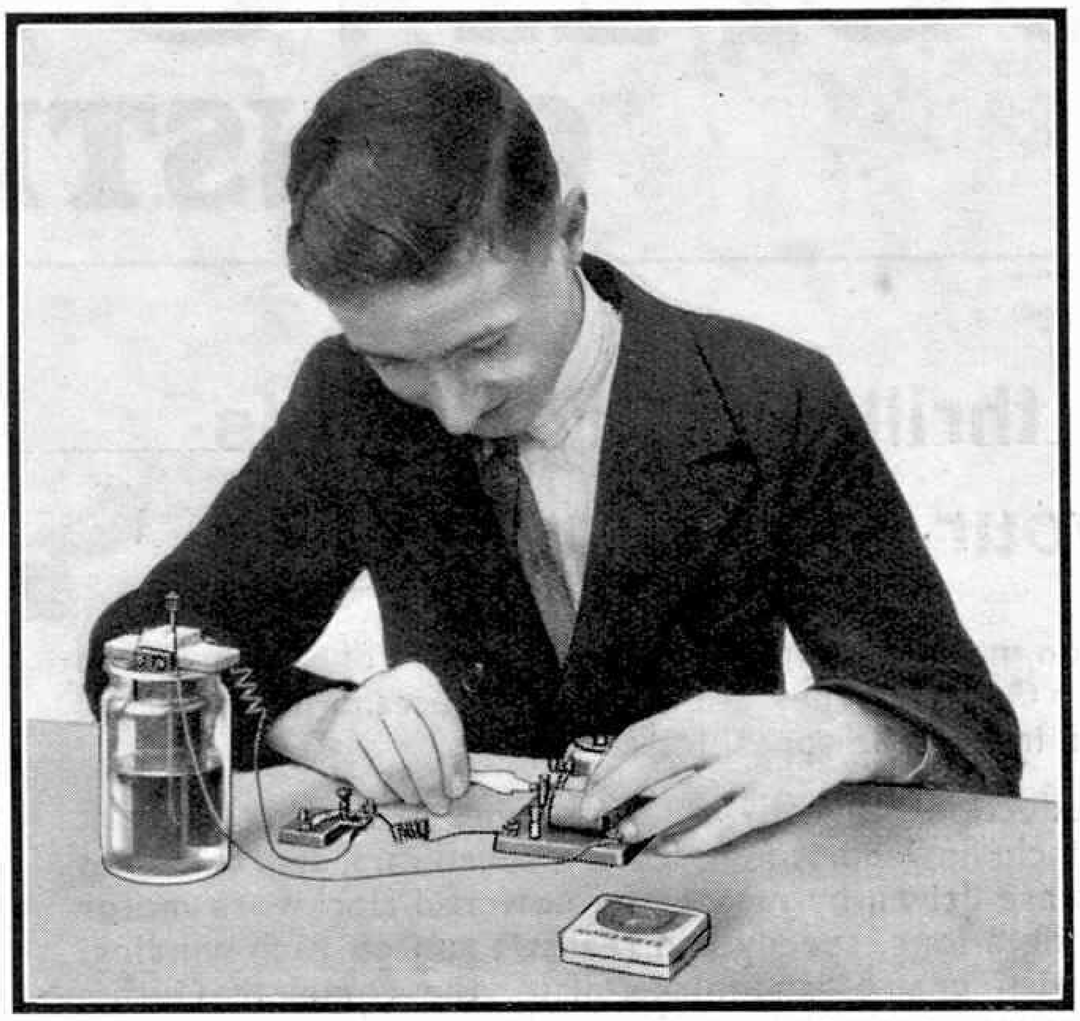
The making of permanent magnetic maps by means of gaslight photographic paper, as described in the instructions for the No. 1 Elektron Outfit, is great fun. All the operations can be carried out in an ordinary room, and a collection of maps made in this manner is of considerable value and interest.

The experiments with floating magnets described in the No. 1 Elektron Manual can be extended in various ways with most interesting results. The symmetrical formations taken up by the different groupings of magnets are always surprising to those who see them for the first time, and these experiments can be relied upon to amuse friends. The fishing game with magnets for "bait," and the electrical fortune-telling game, which also are described in the No. 1 Manual, are never-failing sources of entertainment.

The experiments with electro-magnets that can be performed with the materials contained in the Elektron Outfit No. 2 are even more fascinating than those with permanent magnets, and here again the experiments described in the Manual are only a few of those that can be carried out. Many others will quickly suggest themselves to all keen boys, and particularly to those who also possess Meccano Outfits. A Meccano

crane, even of a very simple type, can be made to provide endless fun if fitted with an electro-magnet, so that it will pick up nails, nuts, or other small pieces of iron or steel, swing them into any desired position, and deposit them immediately the current is switched off. Owners of Hornby railways will find it good fun to load up open wagons by means of an electro-magnetic crane in this manner.

The Elektron Outfit No. 2 contains the necessary materials for building an efficient Electric Bell. The construction of the Bell is exceedingly interesting in itself, and provides a practical demonstration of the principle upon which many familiar electrical appliances operate. When the construction is finished the fun is by no means over, however, for the completed Bell can be used in a great variety of interesting ways. First of all there are the uses of the Bell in the same manner as the ordinary household bell. These are fairly obvious, and nothing need be said about them. Much greater fun can be had by using the Bell for signalling. For this purpose it is best to remove from the Bell the Gong, Bell Rod and Hammer, thus converting the Bell into a buzzer.

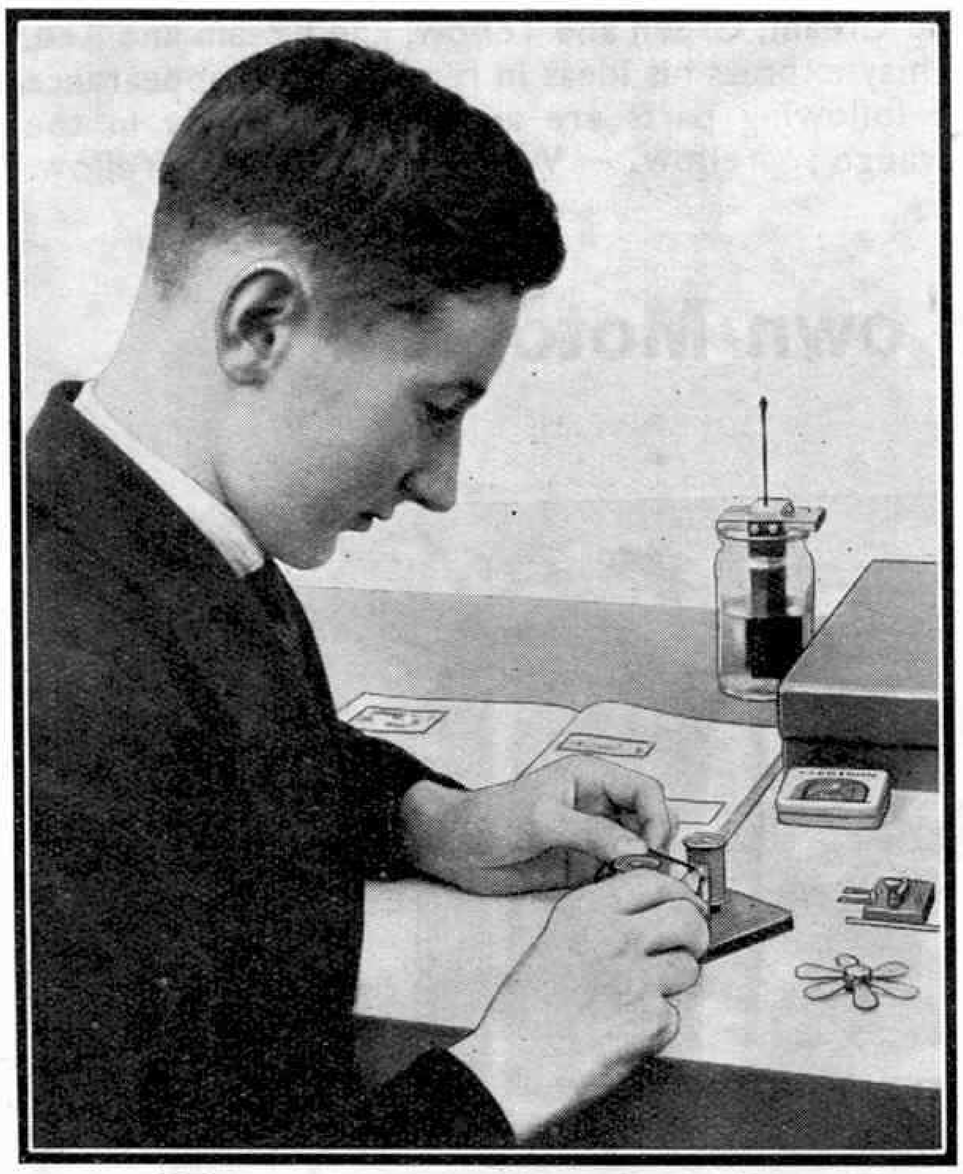


When the Bell is completed it is adjusted to give the loudest ring, and is then ready for use in signalling, as suggested in the accompanying article.

For the best fun the assistance of a friend is necessary, so that one experimenter can take charge of the Switch in order to despatch messages, and the other can read the transmitted signals by listening to the sounds made by the buzzer which, if possible, should be in another room, connected up by extra lengths of wire. The greatest fun of all is obtained when two owners of No. 2 Elektron Outfits pool their resources. Then each one can have at his disposal both a Switch and a buzzer, so that messages can be transmitted in both directions.

It is not difficult to devise a simple system of signals that will be of considerable interest for transmitting messages in this manner, but by far the best plan is to use the Morse code of dots and dashes, which is printed on page 13 of the No. 2 Elektron Manual. At first sight this code seems as though it would be very difficult to learn, but if it is split up into sections of three or four letters and practised regularly it will be found easy to memorise. For use with the buzzer, the sounds, rather than the printed arrangement of dots and dashes, should be learned. For instance, the letter A should not be memorised as "dot dash," but as a short sound followed by a long one, as in the words "alone," or "afar." All the letters except E and T consist of two or more dots and dashes spaced at intervals equal to one dot. A dash should be equal in length to three dots; the interval between two letters of a word should equal one dash, and the interval between two words should equal two dashes. When numerals are to be used, their transmission is preceded by the letters FI, and their completion is indicated by FF.

The lower illustration on this page shows the Elektron Direct Current Motor in process of construction. A part of this Motor that is of special interest is the Commutator Contact Brush. This is a small part, consisting only of a narrow strip of thin brass, but slight variations in its adjustment produce striking effects in the running of the Motor. One end fits on the flat of the Armature Support, and the other makes sliding contacts with the segments of the brass Commutator under the Armature as this rotates. The moment when the Brush touches each section of the Commutator must be carefully timed, in order to obtain the best results.



Fitting up the Elektron Direct Current Motor.

The highest speed is attained when contact is made a little before reaching the neutral position, with the Magnet Cores half-way between adjacent poles of the Armature. A speed of 500 r.p.m. may be obtained from the Motor by careful adjustment, and it is interesting to note that, as the Armature has six poles, this means that 3,000 magnetic impulses are given every minute. It is good fun to vary the position of the Brush and note the effects on the Motor. The changes are brought about by bending the brass a little more or a little less in order to alter the point at which it makes contact with the Commutator.

Four coloured rings of cardboard are included in the Outfit. When these are placed on the Armature of the Motor they form brilliant, and ever-changing combinations of colour as they are whirled round. It is interesting to cut out circles of thin stiff paper, with a small hole in the centre, and to draw and paint on them a variety of patterns of different colours. These, when placed on the Armature of the Motor, will provide an almost endless variety of colour effects.

MECCANO MOTOR CONSTRUCTOR

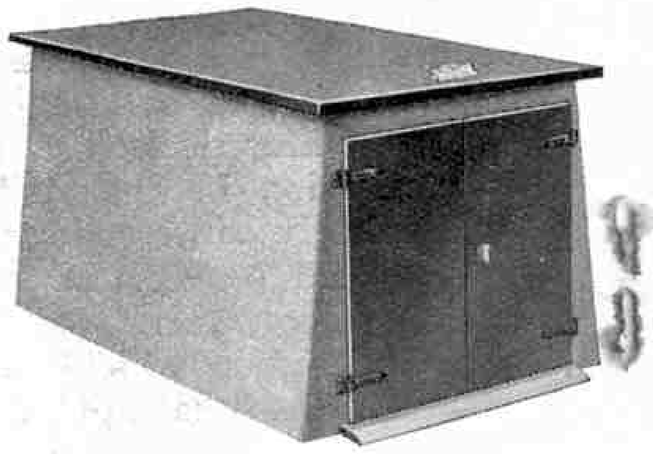
Have the thrills of Brooklands in your own home!

Every boy who is keen on model building will ardently desire one of these fine new Motor Car Constructor Outfits. They are the latest Meccano development and they are sure to have an irresistible appeal for all boys.

Perfect miniature reproductions of many different types of car can be built with these splendid Outfits including sports four-seaters, speed cars, sports coupés and others. All the models are driven by means of a powerful clockwork motor (included in the Outfit), giving a long, speedy and realistic run on each winding. The parts are finished in rich enamel and nickel-plate, the complete Outfits being masterpieces of miniature automobile craftsmanship.

Now is the time to get a Meccano Motor Car Outfit. You will never grow tired of building and running the superb models that you will be able to build. Make up your mind to get one of these splendid Outfits, and see your dealer about it to-day.

Each Meccano Motor Car Outfit is available in four distinct colour schemes—Red and Light Blue, Light Blue and Cream, Green and Yellow, and Cream and Red, so that the model motor-builder may express his ideas in regard to the appearance of his models. In addition, the following parts are available separately in the colours indicated. Body: Orange; Yellow. Wheels: Orange; Yellow. Wings: Orange; Green.



MOTOR CAR GARAGE

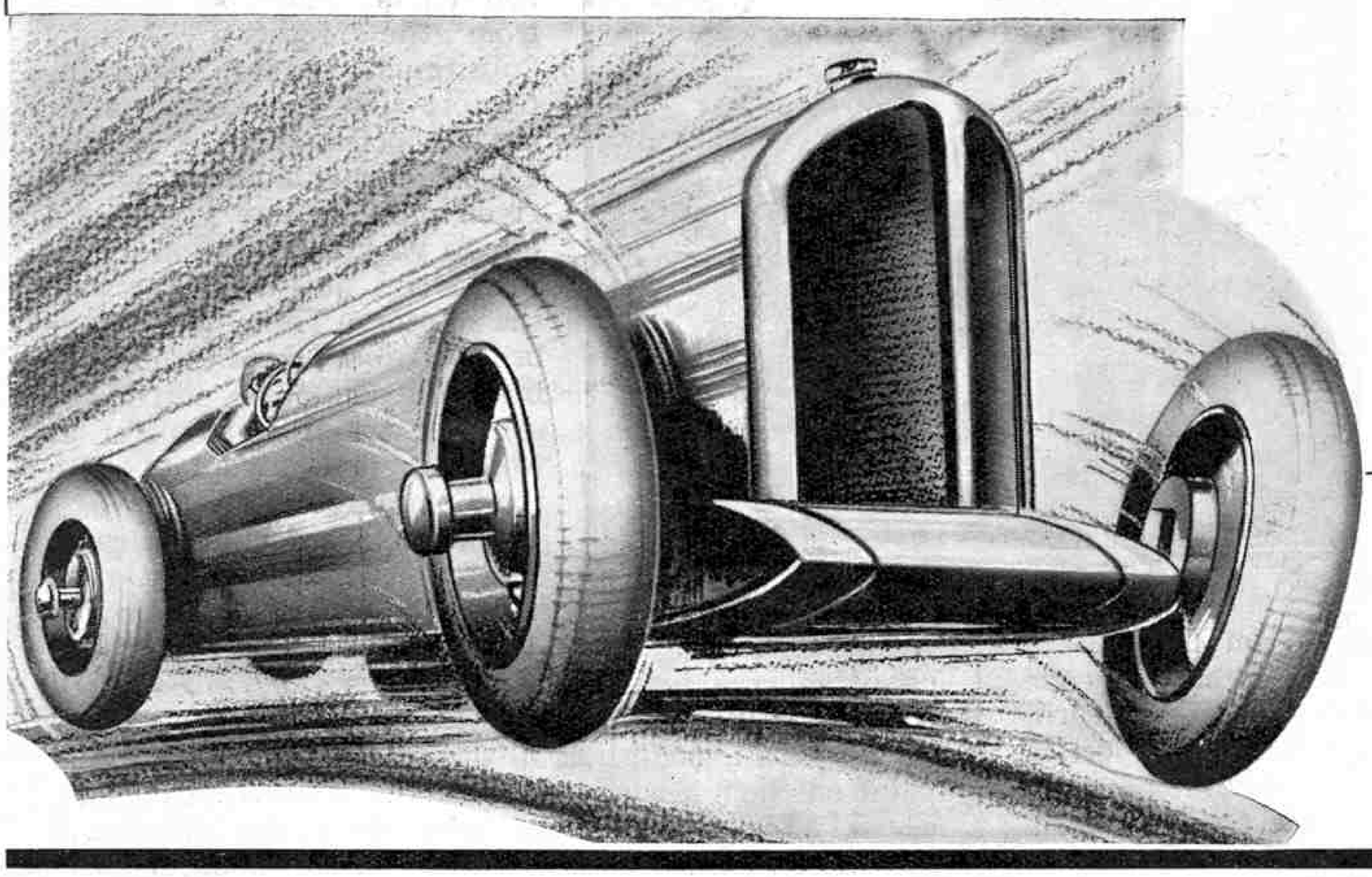
The Meccano Motor Car Garage provides accommodation for any model motor car. It is strongly built, and its rough cast finish gives it an extremely attractive appearance. Price **7/-**

MOTOR CAR LIGHTING SET

This Lighting Set enables the headlamps of Motor Car models built with the 1933 No. 2 Motor Car Outfit to be electrically lighted. Price **2/6**

The Lighting Set cannot be used with 1932 type Motor Car Outfit models unless the latest Headlamps (price 4d. each) and Instrument Board (price 6d.) are added.

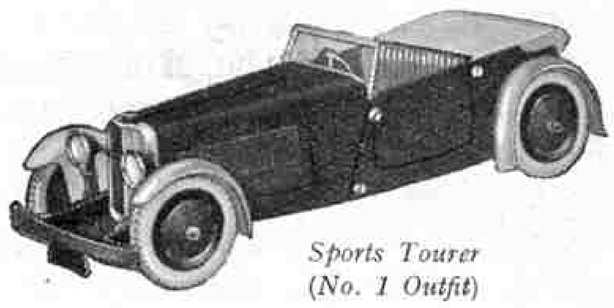
Build your own Motor Cars!





No. 1 Meccano Motor Car Outfit

MECCANO LTD. -



Sports Tourer
(No. 1 Outfit)

TOR CAR

MECCAUTO 538189



No. 1 MECCANO MOTOR CAR OUTFIT

The motor car models that can be built with this Outfit are the finest you ever saw. Look at the examples illustrated below and think of the fun you could have building this and other types equally graceful and realistic.

No. 1 Outfit is available in four different colour combinations—Red and Light Blue, Light Blue and Cream, Green and Yellow, and Cream and Red. It is supplied complete with powerful Clockwork Motor. Price **14/6**

Built-up models of motor cars made with No. 1 Outfit are available at the following prices :—

1/1 Sports Tourer (with hood) ...	15/-	1/3 Road Racer	14/6
1/2 Saloon Coupé	15/6	1/4 Sports Tourer	14/6

IMPORTANT.—It should be noted that the No. 1 Motor Car Outfit parts cannot be used in conjunction with those of the No. 2 Outfit.

No. 2 MECCANO MOTOR CAR OUTFIT

Larger models of a superior type can be built with No. 2 Outfit. They are perfectly designed, beautifully finished and the most attractive examples of constructional engineering ever invented for the delight of boys. Their handsome and realistic appearance may be judged from the illustrations below.

No. 2 Outfit is available in four different colour combinations—Red and Bright Blue, Light Blue and Cream, Green and Yellow, and Cream and Red. A powerful Clockwork Motor that gives a run of 150 feet on one winding is included. Price **25/-**

CHOICE RANGE OF COLOURS

If extra parts in any of the colours mentioned above are required they may be purchased from any Meccano dealer. By adding separate parts in various colours you are able to construct models in a number of pleasing combinations, thus adding considerably to the interest.

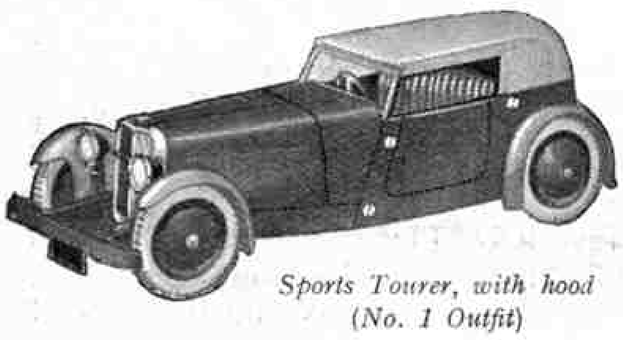
In addition to the four standard colour combinations, the following No. 1 Outfit parts are available in the colours indicated :—

Body Sections : orange, yellow. Wheels : orange, yellow. Wings : orange, green.

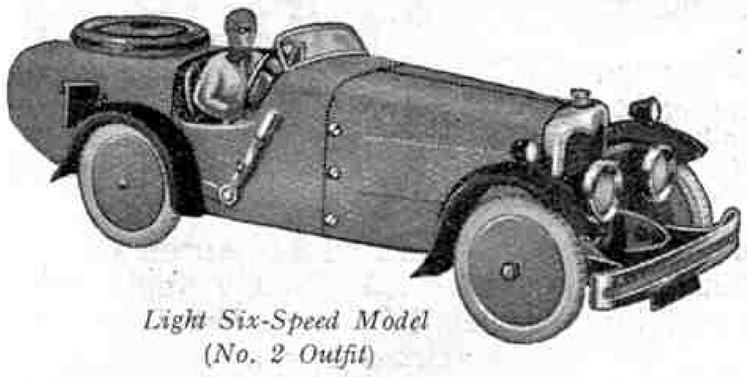


No. 2 Meccano Motor Car Outfit

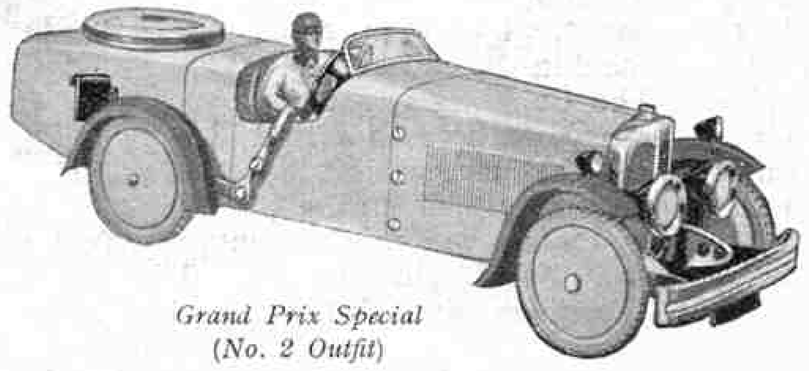
- BINNS ROAD - LIVERPOOL 13



Sports Tourer, with hood (No. 1 Outfit)



Light Six-Speed Model (No. 2 Outfit)



Grand Prix Special (No. 2 Outfit)

The Month's New Model

A Front Wheel Drive Chassis

THE new Meccano model to be described this month represents a motor car fitted with the Alvis type of front wheel drive transmission. It is fitted with a very compact three-speed and reverse gear-box, a neat single plate clutch, and internal expanding brakes on all four wheels.

The model is commenced by building the chassis, the construction of which is shown in Figs. 1 and 4. The front springs can be seen in Fig. 4, showing an underneath view of the model before the gear-box and Motor unit is mounted in place. They are constructed in the following manner. There are four three-leaf springs of the quarter elliptic type on each side of the chassis, each consisting of one 2", one $1\frac{1}{2}$" Strip, and one Flat Bracket bolted at one end to the chassis. The other ends of the springs terminate in Hinges secured to the frame 1, which consists of two $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips and two $1\frac{1}{2}$" Strips, the Strips being spaced away from the ends of the Double Angle Strips by Washers.

A "spider" is secured by Set Screws to each end of a Double Arm Crank 2, the lower spider being packed out from the Crank by two Washers, while the upper one is fitted flush against the Crank. The Double Arm Crank is retained in the frame by means of a 1" Rod and a Threaded Pin inserted in the upper and lower spiders respectively. They are secured in the spiders by Grub Screws, and four Washers serve to space the upper spider, and one Washer the lower spider, from the frame.

The universal-coupling drive to each of the front wheels consists of a 1" Threaded Rod 6 forming the stub axle to which are secured, by lock-nuts, two $\frac{1}{2}" \times \frac{1}{2}"$ Angle Brackets, the slotted portions of which must be parallel to one another. The whole unit must be secured very rigidly to the Rod. The arms of the Angle Brackets are bent slightly towards one another. The end of a 2" Rod 5 carries a Collar, and this is mounted loosely between the Angle Brackets by passing Set Screws through the slotted holes and screwing them home, in the tapped holes of the Collar, until the Rod 5 is nipped by them. The stub axle is inserted in the boss of the Double Arm Crank 2, and the road wheel is then secured to its end by duplicate Set Screws. It will be found, the centre of the universal coupling is practically coincident with the centre line of the pivot pin, and that the latter, when produced, falls within $\frac{1}{4}$" of the centre of the wheel track.

A Crank 3 is fixed rigidly to the end of each 1" Rod pivot as shown in Fig. 4, and a 5" Rod acts as a drag link by connecting the Crank to a Swivel Bearing 4, which is mounted on a $\frac{1}{2}$" Bolt held in the end bore of a Coupling. The Coupling is secured in its end transverse bore to a Rod journalled in the chassis girders and carrying at its upper end a $\frac{1}{2}$" Pinion. This Pinion will mesh eventually with a Worm on the steering column. A 1" Rod 4a is fixed in the centre transverse bore of the Coupling, and this is attached to the track rod by a Swivel Bearing.

The next item that requires our attention is the rear wheel suspension and the brakes. This is shown in detail in Fig. 2, which is a view taken from underneath the chassis and with the road wheel removed from its stub axle. The spring 38 is of the cantilever type, and it consists of one $3\frac{1}{2}$", one 3", one $2\frac{1}{2}$" and one 2" Strip, all bolted together at one end to a $1\frac{1}{2}$" Angle Girder 39 fixed to the chassis. The stub axle is secured in the boss of a Crank that is bolted on the inside of a pivot arm 37, the two parts being separated the space of one Washer.

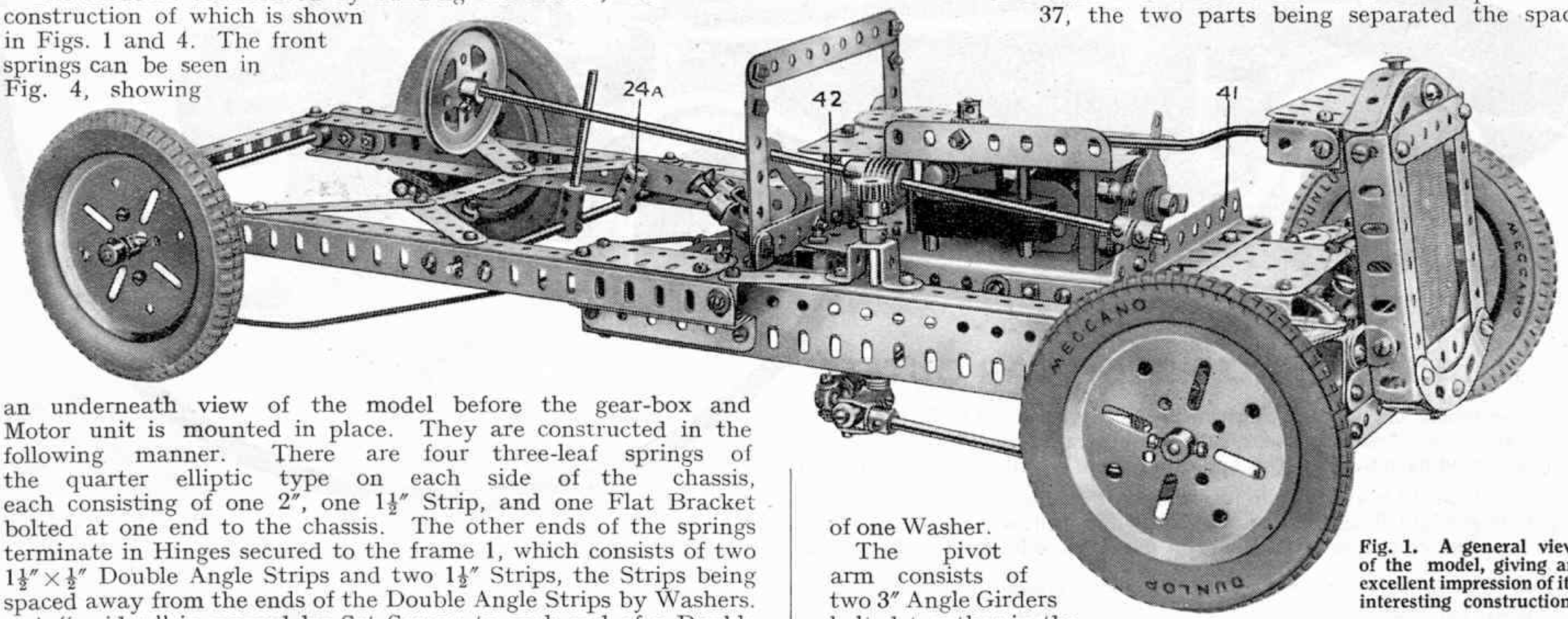


Fig. 1. A general view of the model, giving an excellent impression of its interesting construction.

The pivot arm consists of two 3" Angle Girders bolted together in the form of a channel section, and mounted freely at one end on a Rod that passes through the chassis. A 3" Strip is bolted over the slotted holes of one of the Girders to provide a bearing for the pivot. The arm is connected to the spring by means of a Flat Bracket 40, which is attached pivotally by a lock-nutted Bolt to a $\frac{1}{2}" \times \frac{1}{2}"$ Angle Bracket on the spring. The other end of the arm is inserted in the space between the Crank holding the stub axle and the pivot arm, the stub axle being passed through the hole in the Flat Bracket.

The brake is of the internal expanding type, and consists of two 2" Strips mounted together at one end on a Bolt locknutted in the centre hole of a $1\frac{1}{2}$" Strip. The end hole of the $1\frac{1}{2}$" Strip is attached pivotally to the arm 37 and the other end is fitted with a Handrail Support. The 2" Strips, carrying the Collars that form the brake shoes, ride in the groove of a 1" fast Pulley 36 that is loose on the stub axle, and the Strips are retained in the groove by a short length of Spring Cord fitted as shown in Fig. 2. By moving the $1\frac{1}{2}$" Strip to the left the 2" Strips are forced apart, and consequently the Collars are pushed against the rim of a Wheel Flange forming the brake drum, which is bolted to the road wheel.

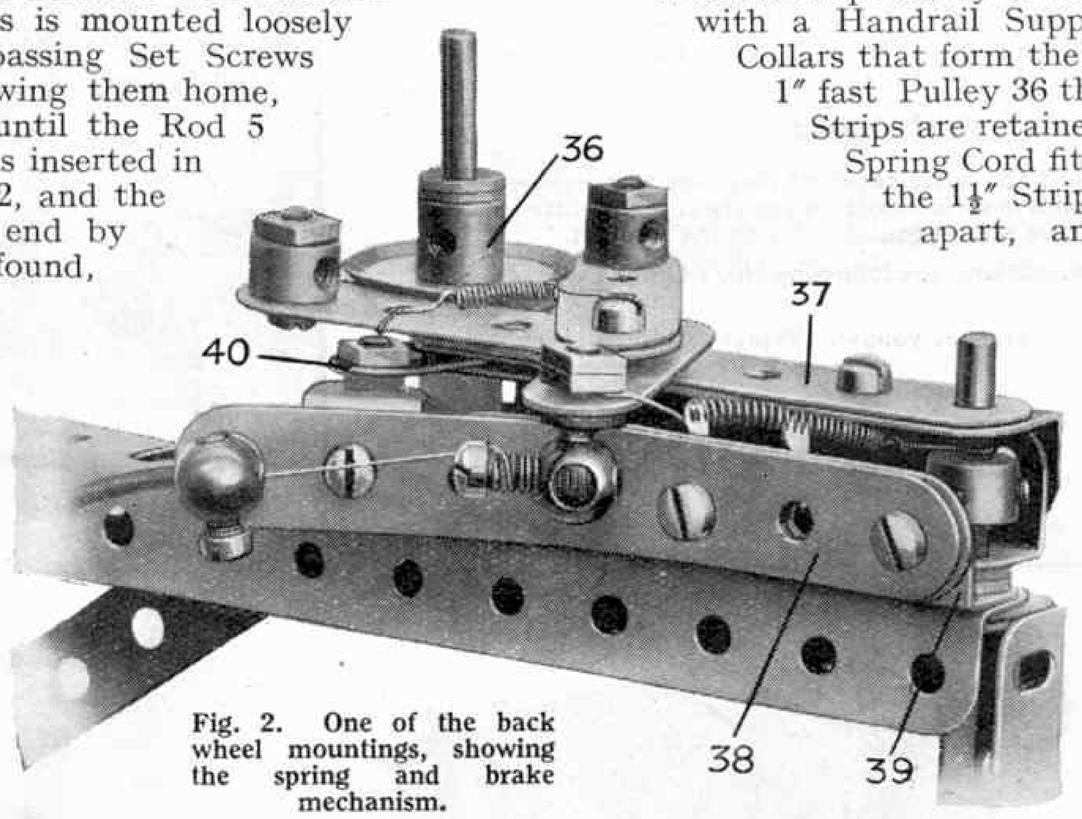


Fig. 2. One of the back wheel mountings, showing the spring and brake mechanism.

The 6-volt Motor, gear-box, clutch, differential, and front brakes, shown in Fig. 3, all form part of a compact unit. Each of the gear-box side plates consists of a $4\frac{1}{2}$" Flat Girder, that on the far side of the Motor being bolted to the flange of the Motor by its slotted holes, and the one on the near side being attached to a $4\frac{1}{2}$" Angle Girder spaced away from the Motor side plate by three 2" Strips.

The Rod 8 is journalled in three bearings, a $2\frac{1}{2}$" Flat Girder 33a, a $2\frac{1}{2}" \times 1"$ Double Angle Strip 8a, and a $2\frac{1}{2}$" Strip 7. The Double Angle Strip 8a is bolted to the side plates of the gear-box and it carries a Flat Trunnion in the top hole of which one end of the layshaft is journalled. The Strip 7 is one of two that are secured to the gear-box sides by means of $\frac{1}{2}" \times \frac{1}{2}"$ Angle Brackets. The Rod

15 runs in the second of the Strips 7, and also in another $2\frac{1}{2}'' \times 1''$ Double Angle Strip, which carries a Flat Trunnion forming a bearing for the other end of the layshaft. Two Washers are placed under the heads of each of the Bolts, retaining the Trunnion in place so that the shanks of the Bolts do not foul the face of the 1" Gear 20. It is very important that all the bearings should be in alignment, especially those in which the Rod 8 runs, for as there are three bearings, alignment has to be very carefully carried out if the Rod is to run easily.

The clutch is of the single plate type and consists of a $1\frac{1}{2}''$ Contrate Wheel 9 free on the Rod 8, which is driven from the Motor armature spindle through a reduction gear of 3 : 1. The floating plate consists of a $\frac{1}{2}''$ loose Pulley fitted with a $\frac{5}{8}''$ Rubber Ring, and is pressed against the face of the Contrate Wheel by a $\frac{3}{4}''$ Flanged Wheel mounted in a Socket Coupling which represents the withdrawal plate. A Collar 10 is secured to the Rod in such a manner that its Grub Screw is always in engagement with the slot of the Socket Coupling, thus permitting limited longitudinal movement to the unit and at the same time allowing it to rotate the Rod. Half of a Compression Spring is placed between the Collar and the recess in the Socket Coupling in order to keep the parts of the clutch in contact. The Contrate 9 is prevented from moving away from the withdrawal plate by a Collar secured on the Rod.

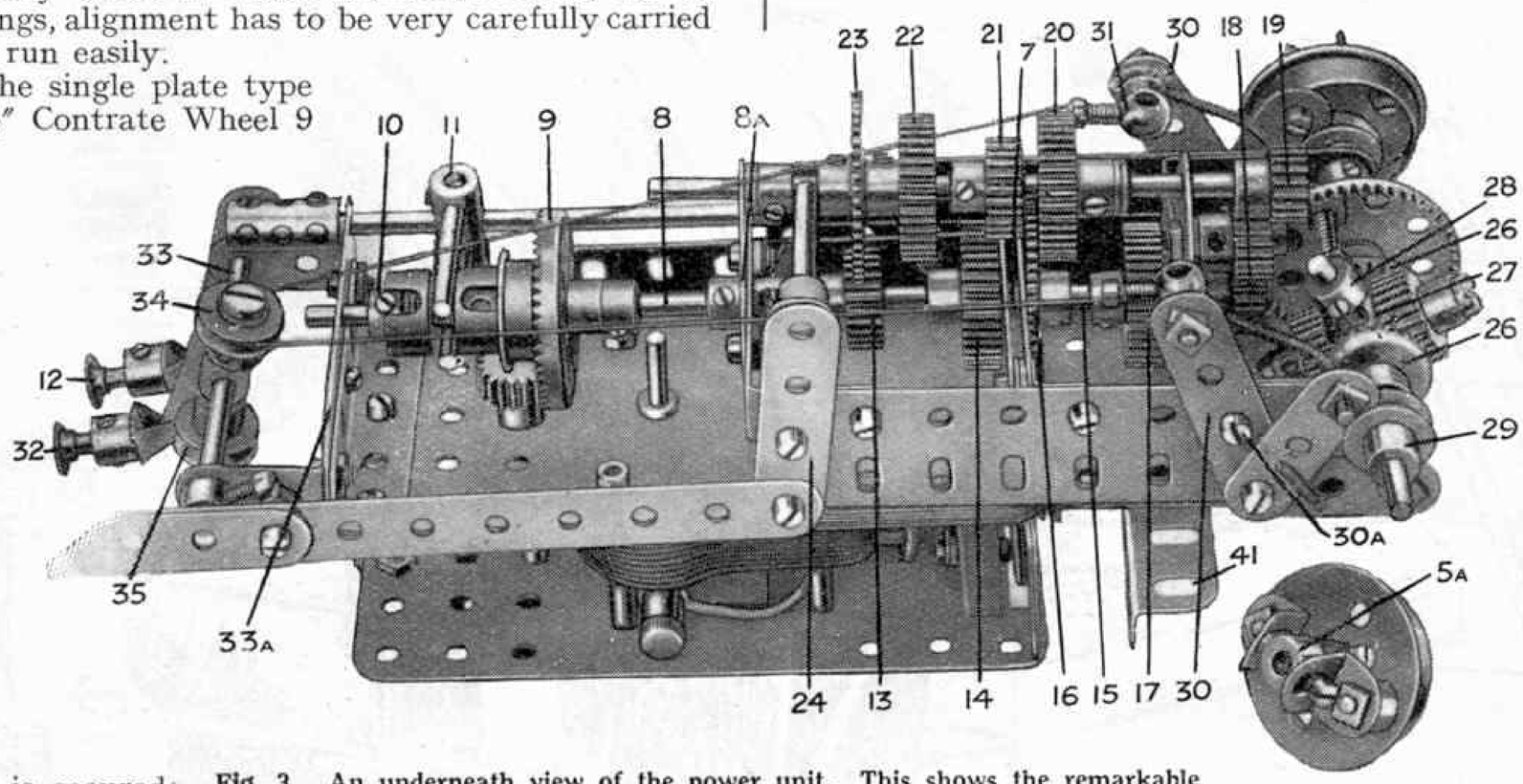


Fig. 3. An underneath view of the power unit. This shows the remarkable compact appearance of the clutch, gear-box, differential, etc.

The clutch withdrawal mechanism consists of a Rod sliding in suitable bearings and carrying at one end a Coupling to which is attached a 2" Strip. This Strip pivots on the end of a Rod 33 and its upper end carries the clutch pedal proper 12. A Coupling 11 secured to the Rod carries also two short Rods that engage with the groove of the Socket Coupling.

The differential, as will be seen from Fig. 3, is not the same as that in the standard chassis, on account of space. Two $\frac{3}{4}''$ Contrate Wheels 26 are secured on the ends of two separate Rods, the outer ends of which are journalled in the ends of the gear-box side plates, and the inner ends in the longitudinal bore of a Coupling. The $\frac{3}{4}''$ Pinions 27 mesh with the Contrates, and are mounted freely on Pivot Bolts inserted in the centre tapped holes of the Coupling, and screwed home sufficiently to grip a Rod in the centre transverse hole of the Coupling. This Rod carries, at each end, Collars 28 in which are inserted 1" Screwed Rods. A $1\frac{1}{2}''$ Contrate, free to revolve on its Rod, is locked to the Screwed Rods, and is spaced from the adjacent $\frac{3}{4}''$ Contrate by two Washers.

The front brakes work in a similar manner to the rear brakes, but they are designed on a smaller scale. In Fig. 3 the brake drum on the near side has been removed in order to show internal details of the brake. It will be seen that the brake operating lever is a 2" Strip 30 pivoted on a Bolt 30a with two $1\frac{1}{2}''$ Strips mounted pivotally at its lower end. The $1\frac{1}{2}''$ Strips ride in the groove of a $\frac{1}{2}''$ fast Pulley 29 that is loose on the Rod, and the Bolt shanks on their ends bear on the inside rim of the Flanged Wheel forming the brake drum, when the Strip 30 is moved to the left. Four Washers space the Flanged Wheel away from the boss of the $\frac{1}{2}''$ fast Pulley.

The brake pedal 32, Fig. 3, consists of a Buffer Shank and an End Bearing bolted to the end of a Crank on the Rod 33. The two $\frac{1}{2}''$ fast Pulleys 34 and 35 are mounted on Pivot Bolts that are screwed into a Collar on the Rod 33 until the Rod is gripped by them. The brake-operating wire is passed round the Pulley 34 so that its ends may be attached to $\frac{3}{8}''$ Bolts inserted in the tapped holes fo Handrail Supports 31 on the upper extremities of the brake operating levers. By this arrangement both brakes are applied with equal force. Adjustments may be carried out by turning the $\frac{3}{8}''$ Bolts in the Handrail Supports 31.

The back brakes are actuated in a similar manner, the controlling wire passing round the Pulley 35 so that, on depressing the pedal, a simultaneous application of the four brakes is made. Owing to the vertical movement of the back wheels, the control wire must pass through an outer flexible sheath on the Bowden cable principle. This sheath is composed of Spring Cord, and its manner of attachment should be clear on reference to Figs. 2 and 4. A stop consisting of a $\frac{3}{8}''$ Bolt inserted in a Collar comes in contact with a fixed Bolt shank in order to limit the movement of the brake pedal shaft 33.

The brake control cables consist of the wire taken from the inside of a length of electric light flex.

The gear change lever is carried on a cross shaft that is journalled in the chassis girders, and is prevented from free rotation by means of a Spring Clip mounted on the Rod so that its lugs press against a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket bolted to the inside of the chassis girder. The Coupling 24a on the cross shaft is connected by means of a Strip to a 2" Strip 24 pivoted on the side of the gear-box. The upper end of this Strip has a Rod attached to it by a Crank, and the Rod locates between the boss of the Gear 23 and a Collar on the layshaft, so that on moving the gear lever the layshaft is slid longitudinally in its bearings.

The main features of the radiator will be seen in Fig. 1, but a point that requires stressing is the method of mounting the radiator tubes. The tubes consist of a number of lengths of Spring Cord each of exactly the same length and provided with a loop at each end. The loops are threaded on to two Rods that are slipped under the projecting shanks of $\frac{3}{8}''$ Bolts situated at the bottom of the radiator. When the Spring Cord is in place their turns should present a slightly extended appearance and the lengths be correctly and equally spaced on the Rods.

The water tank consists of two 3" Flat Girders bolted to Double Brackets at the rear of the radiator proper, and the sides are filled in by a 3" Strip and two $1'' \times \frac{1}{2}''$ Angle Brackets. The radiator cap is a Buffer Shank and the two lower corners of the radiator are filled in by 1" Triangular Plates, which are held in place by two $\frac{3}{4}''$ Bolts.

The gear-box is mounted on the three point suspension system. The Girder 41, Fig. 3, is bolted securely to the gear-box and frame, but Girder 42 is attached by one Bolt only to the gear-box.

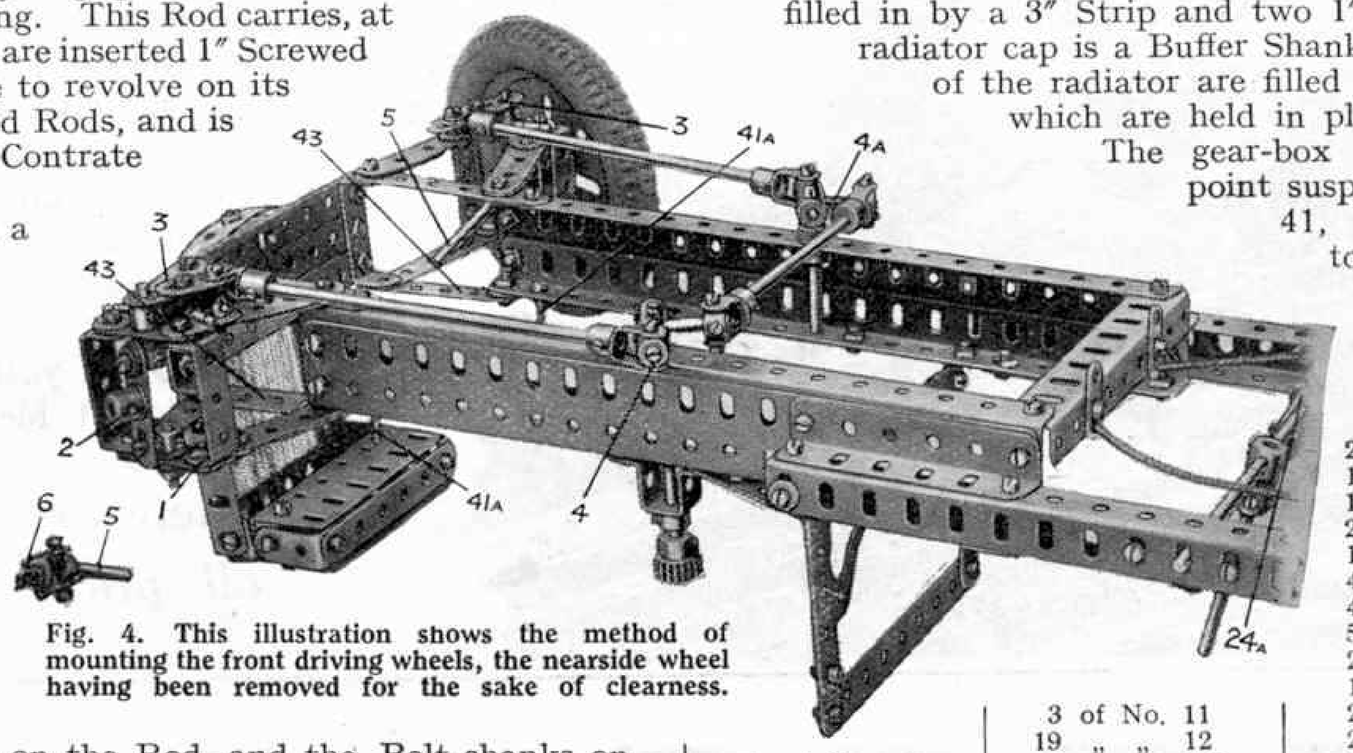
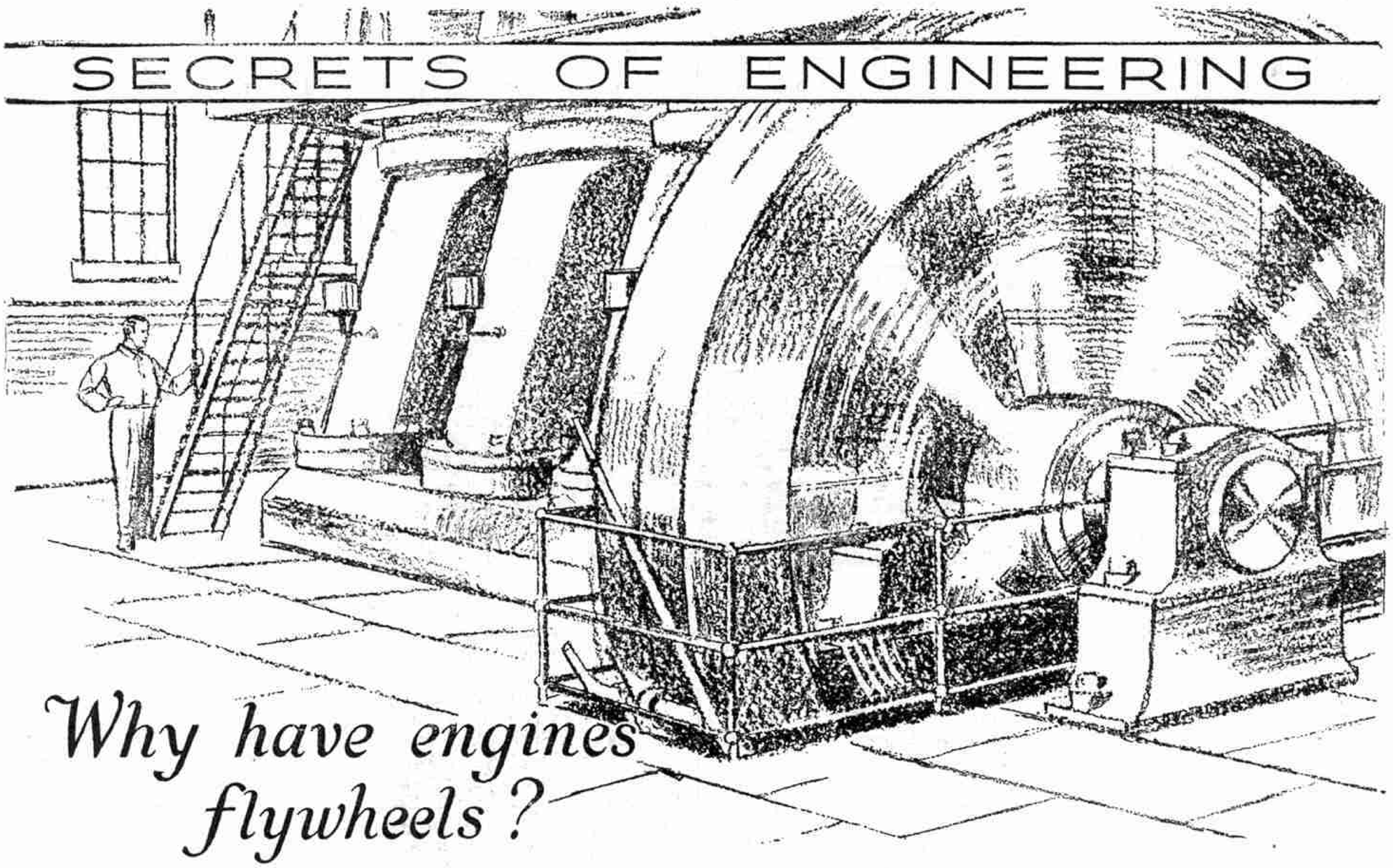


Fig. 4. This illustration shows the method of mounting the front driving wheels, the nearside wheel having been removed for the sake of clearness.

Parts required:

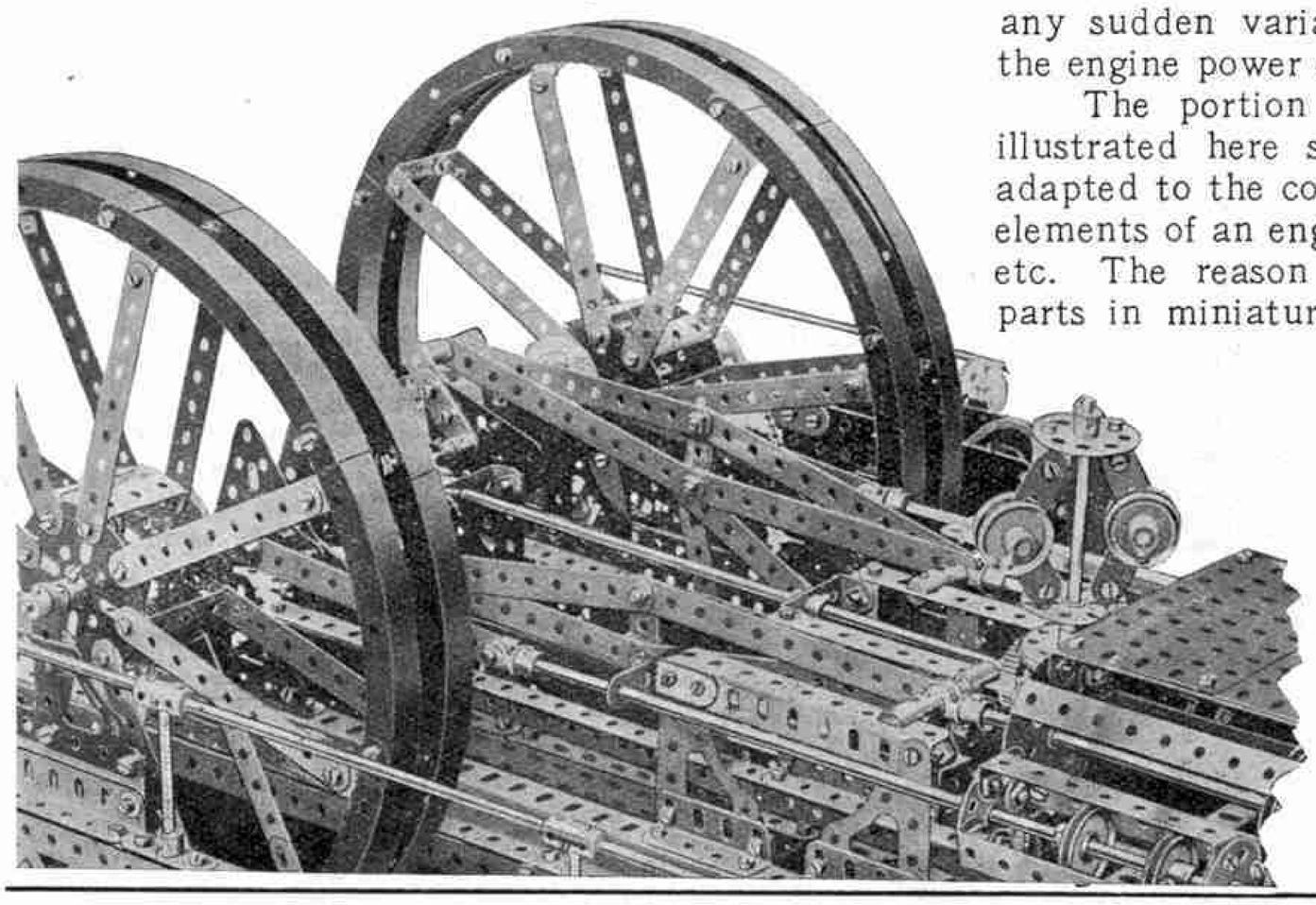
2	of No.	20	
1	„	„	20a
1	„	„	20b
2	„	„	22
1	„	„	23
4	„	„	23a
4	„	„	25
5	„	„	26
2	„	„	27
1	„	„	27a
2	„	„	28
2	„	„	29
4	„	„	31
1	„	„	32
1	„	„	35
145	„	„	37
32	„	„	37a
80	„	„	38
1	„	„	45
3	„	„	46
6	„	„	48
1	„	„	58
32	„	„	59
8	„	„	62
2	„	„	62b
7	„	„	63
1	of No.		72
2	„	„	77
4	„	„	82
3	„	„	89a
2	„	„	103a
2	„	„	103c
2	„	„	103e
1	„	„	103f
2	„	„	108
1	„	„	111
6	„	„	111a
16	„	„	111c
8	„	„	114
2	„	„	115
3	„	„	120a
2	„	„	126a
7	„	„	136
2	„	„	137
4	„	„	142b
2	„	„	147b
1	„	„	155
8	„	„	165
2	„	„	166
1	„	„	171
1	„	„	312
1	6-volt Motor		
1	of No.		2
6	„	„	2a
4	„	„	3
16	„	„	4
6	„	„	5
23	„	„	6
20	„	„	6a
4	„	„	8
4	„	„	8a
3	„	„	9a
6	„	„	9c
2	„	„	9d
2	„	„	9f
17	„	„	10
3	of No.		11
19	„	„	12
2	„	„	12b
1	„	„	13
1	„	„	13a
1	„	„	14
3	„	„	15
1	„	„	15a
3	„	„	16
3	„	„	16a
3	„	„	16b
3	„	„	17
8	„	„	18a
4	„	„	18b
1	„	„	19s
4	„	„	19b

SECRETS OF ENGINEERING



Why have engines flywheels?

Many types of engines are provided with flywheels in order to distribute their power evenly. A rapidly spinning wheel tries to maintain a uniform speed and resists any force that tends to make it spin faster or slower. In this manner the flywheel of an engine prevents to a large extent any sudden variations in speed resulting from fluctuations in the engine power or in the load.



The portion of a Meccano Twin Cylinder Steam Engine illustrated here shows how effectively Meccano parts can be adapted to the construction of flywheels and to other important elements of an engine, such as centrifugal governors, crankshafts, etc. The reason is that Meccano parts are real engineering parts in miniature—they can all be used in exactly the same manner as the corresponding parts in real engineering practice. More important still, they are all standardised and interchangeable, and thus can be used to make hundreds of different engineering models.

Ask your dealer to show you the latest Meccano Outfits.

There are Meccano Outfits at all prices from 1'3 to 415'-

MECCANO

The Toy that made Engineering Famous

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

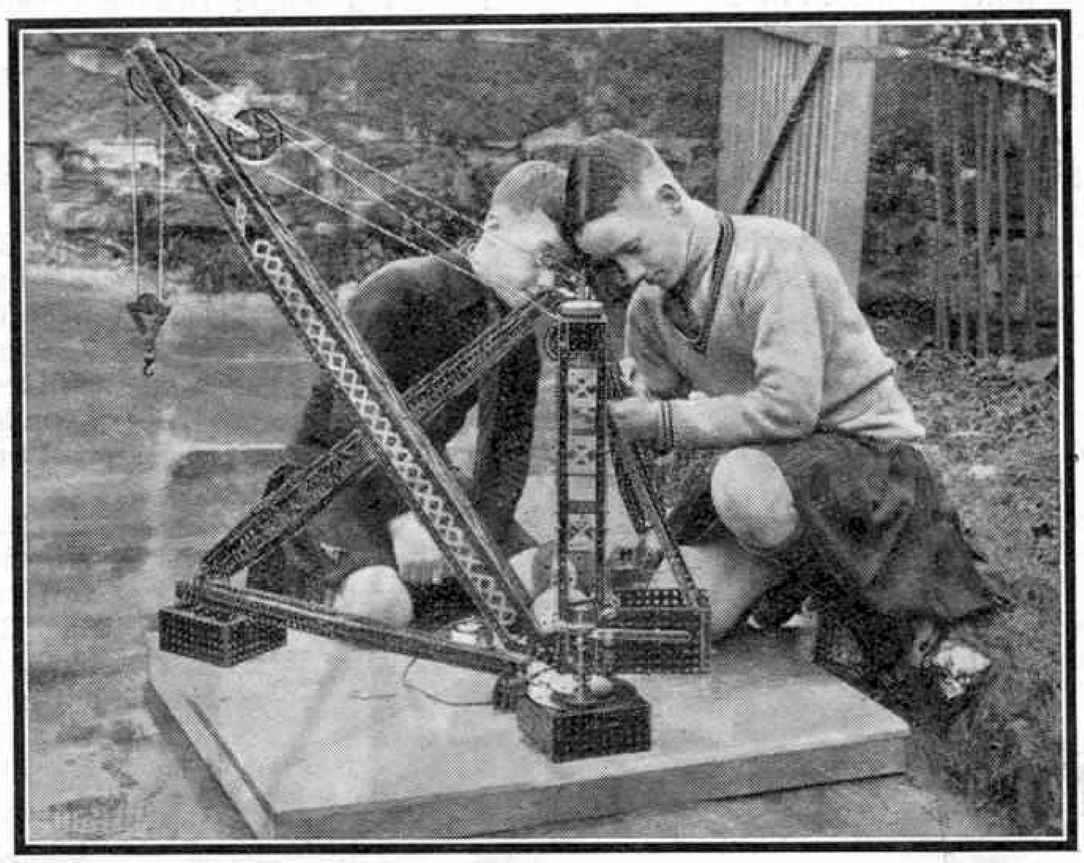
Model-Building Competitions

Contest for all kinds of Meccano Models

In this Competition we offer many splendid prizes for the best and most original Meccano models of any kind submitted to us by readers of the "*M.M.*" Competitors should try to think of something new and then set to work and build it neatly in Meccano. When the model is completed, it is only necessary to obtain a photograph of it, or if this is not possible, make a neat sketch, and send it along.

Any number of parts may be used in building the model, and any kind of subject may be chosen. There are interesting machines and mechanisms to be seen everywhere, so that the choice of a novel and easy-to-build subject is not difficult. There is no reason to be disheartened if you possess only a small Outfit, for we are constantly reminding readers that a simple, well-built model stands a far greater chance of success in our competitions than a large but badly designed and poorly constructed model. There are no entry forms to fill in and no fees to pay.

Every model submitted must be the competitor's own handiwork both in design and construction, although photographs or drawings need not be his own work. Actual models must not be submitted for consideration.



C. Jobson, Dundee (on right) at work on the fine model crane with which he won First Prize in the "March" Model-Building Contest (Section B).

The Competition will be divided into three Sections as follows :—Section A, for readers living in the British Isles and over 14 years of age ; Section B, for readers living in the British Isles and under 14 ; Section C, for competitors of all ages living overseas. The ages of all competitors will be taken into consideration when judging the entries.

The prizes to be awarded in each of Sections A and C are:– First : Meccano or Hornby Goods value £3-3s. Second : Goods value £2-2s. Third : Goods value £1-1s. Five Prizes of Goods value 10/6 ; Five Prizes of Goods value 5/–.

The Prizes in Section B will be :—First : Goods value £2-2s. Second : Goods value £1-1s. Third : Goods value 10/6. Ten Prizes of Goods value 5/–.

There will also be a number of consolation prizes in each Section.

The following instructions must be followed closely. The competitor's age, name and address, and the name of the Competition ("Autumn" Contest) must be written on the back of each photograph or drawing submitted. The envelope must be addressed "Autumn Model-building Contest," Meccano Ltd., Binns Road, Liverpool 13. Closing dates :—Sections A and B, 30th November, 1933. Section C, 28th February, 1934.

"Aeroplane Constructor" Model-Building Contest

The parts contained in the Meccano Aeroplane Constructor Outfits enable a great variety of interesting types of aeroplanes to be built in addition to those described and illustrated in the Instruction Manuals. To encourage experiment in this direction we are offering a number of prizes for the most original models submitted to us by readers of the "*M.M.*" Competitors may choose any type of aeroplane or seaplane for their subject, but the model must be built from Meccano Aeroplane Constructor parts. Competitors who possess an ordinary Meccano Outfit may use a few standard parts in conjunction with the Aeroplane Constructor parts if they wish, but the principal portions of the model must be made with the Aeroplane parts.

It is only necessary to send either a photograph or a drawing of the model. The actual model must not be sent.

There will be two Sections—A, for Competitors of all ages living in the British Isles ; B, for competitors of all ages living Overseas. In each Section a separate set of prizes, as indicated in the accompanying panel, will be given for the most interesting and original models.

Competitors must write their age, name and address on the back of each photograph or drawing sent in, and must enclose a short description explaining how the model is constructed.

All entries must be addressed "Third Aeroplane Constructor Contest," Meccano Ltd., Binns Road, Liverpool 13.

Entries for Section A must reach this office before 30th November, 1933. The closing date for Section B is 28th February, 1934.

Photographs or drawings of prize-winning models become the property of Meccano Ltd. Unsuccessful entries will be returned, provided that a stamped addressed envelope is enclosed with the entry.

Since the first Aeroplane Constructor Outfits were introduced, several new parts have been added. Competitors who wish to bring their Outfits up to date should ask their dealer for our latest price lists.

The Prizes

A separate set of prizes as follows will be awarded in each of the Sections A and B.

First Prize : Meccano or Hornby goods value £2.2s.

Second Prize : Meccano or Hornby goods value £1.1s.

Third Prize : Meccano or Hornby goods value 10/6.

Twelve Prizes of Goods value 5/–.

Twelve Prizes of "Meccano Engineer's Pocket Books."

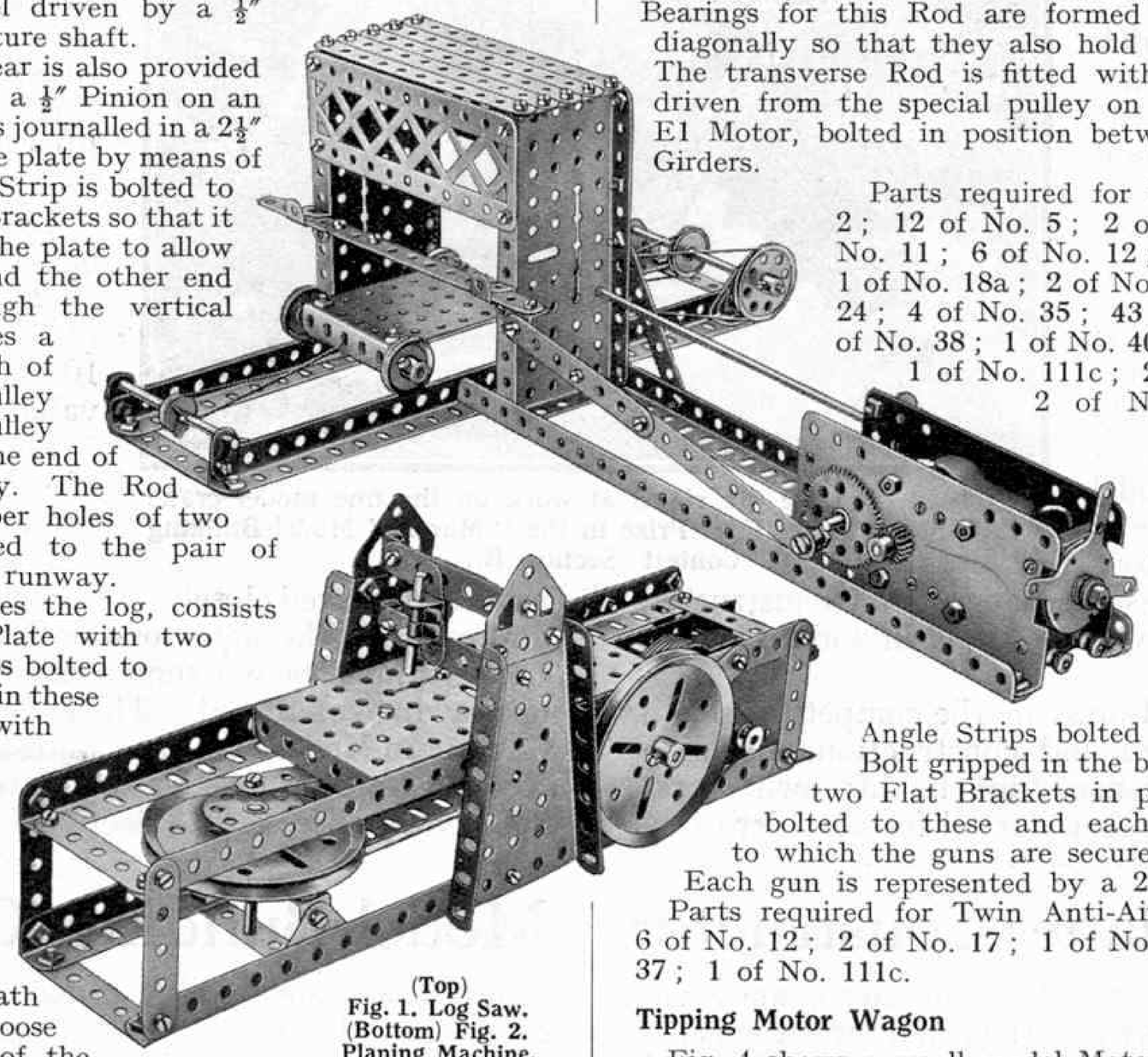
New Meccano Models

Log Saw—Planing Machine—Skimmer Scoop—Lifting Truck, etc.

THE first example dealt with this month is an interesting model of a log-sawing machine. The model is driven by a No. 6 Electric Motor, to the flanges of which two $12\frac{1}{2}''$ Angle Girders are bolted. Across the ends of these is a transverse $12\frac{1}{2}''$ Angle Girder, to which another similar Girder is attached by means of $3\frac{1}{2}''$ Strips. The frame for the saw is built up from two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates, across the upper ends of which are bolted $5\frac{1}{2}''$ Strips. The Plates are braced by $5\frac{1}{2}''$ Braced Girders, and slides for the saw blade are formed from two $\frac{1}{2}''$ Reversed Angle Brackets, on which the saw rests and is held in place by means of Angle Brackets. The saw consists of a $5\frac{1}{2}''$ Strip extended to $7\frac{1}{2}''$ by means of a $3\frac{1}{2}''$ Strip and at the Motor end it carries an Angle Bracket to which a $3\frac{1}{2}''$ Strip is pivoted. The Strip overlaps a $5\frac{1}{2}''$ Strip four holes, the latter being pivoted to a 57-teeth Gear Wheel driven by a $\frac{1}{2}''$ Pinion on the Motor armature shaft.

The Rod carrying the Gear is also provided with a Worm that engages a $\frac{1}{2}''$ Pinion on an $11\frac{1}{2}''$ Axle Rod. The Rod is journalled in a $2\frac{1}{2}''$ Strip fixed to the Motor side plate by means of two Angle Brackets. The Strip is bolted to the elongated holes of the Brackets so that it can be spaced away from the plate to allow clearance for the Worm, and the other end of the Rod passes through the vertical $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Plate and carries a $1''$ Pulley Wheel. A length of cord is passed round the Pulley and also round a $1\frac{1}{2}''$ Pulley fitted on an Axle Rod at the end of the runway for the trolley. The Rod is passed through the upper holes of two Trunnions that are bolted to the pair of Angle Girders forming the runway.

The trolley, which carries the log, consists of a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate with two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted to it. Axle Rods are inserted in these Strips and are provided with $1''$ Pulley Wheels which run on the upper edges of the Angle Girders. A length of Cord is tied to one end of the trolley and passes under a $1''$ Pulley on a Rod at the end of the runway and driven from the Motor. The Cord is then led beneath the trolley and round a $\frac{1}{2}''$ loose Pulley at the other end of the runway, and is tied to the trolley.



(Top) Fig. 1. Log Saw. (Bottom) Fig. 2. Planing Machine.

When the Motor is set in motion the trolley is fed slowly forward and the saw blade moves rapidly to and fro. A hacksaw blade may be substituted for the Strips, and the model can then be made to undertake light sawing work.

Parts required for Log Saw :—7 of No. 2 ; 5 of No. 3 ; 1 of No. 5 ; 4 of No. 8 ; 2 of No. 10 ; 5 of No. 12 ; 1 of No. 13 ; 1 of No. 15a ; 4 of No. 16 ; 1 of No. 21 ; 4 of No. 22 ; 2 of No. 22a ; 1 of No. 23 ; 1 of No. 26 ; 1 of No. 27a ; 1 of No. 32 ; 8 of No. 35 ; 52 of No. 37 ; 7 of No. 37a ; 10 of No. 38 ; 1 of No. 40 ; 2 of No. 48a ; 2 of No. 52 ; 1 of No. 53 ; 3 of No. 59 ; 2 of No. 100 ; 2 of No. 111 ; 2 of No. 125 ; 2 of No. 126 ; 1 of No. 147b ; No. E6 Electric Motor.

Planing Machine

The model illustrated in Fig. 2 represents the type of machine employed for planing metal. The frame is first constructed, and consists of four $12\frac{1}{2}''$ Angle Girders connected together at their ends by means of $2\frac{1}{2}''$ Strips as shown. At the centre of the lower Girders two Sector Plates are bolted, and at their upper ends the Plates carry Trunnions and are connected by $2\frac{1}{2}''$ Strips bolted to Angle Brackets. A space of $\frac{1}{2}''$ is left between the Strips that form slides for the tool rest, consisting of two $1\frac{1}{2}''$ Strips placed one on each side of the slides. A Double Bracket attached to these Strips carries an Axle Rod representing the planing tool.

A $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate forms the work table and slides in the upper pair of Angle Girders. The Plate is retained in position by $\frac{1}{2}''$ Reversed Angle Brackets bolted to it so that they fit beneath the Angle Girders. The Plate should slide freely in its guides, and to obtain smooth working it may be necessary to bend the Reversed Angle Brackets very slightly and to adjust the Angle Girders so that they do not press tightly against the sides of the Plate. A Double Bracket is bolted beneath the Plate and connected by a $2\frac{1}{2}''$ Strip to a Bush Wheel on a vertical $2''$ Rod journalled between a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip and a $2\frac{1}{2}''$ Strip. The Double Angle Strip is bolted between Trunnions attached to the Angle Girders.

The $2''$ Rod also carries a $3''$ Pulley Wheel that is driven from a $1''$ Pulley fitted on a $3''$ Axle Rod mounted across the frame. Bearings for this Rod are formed from two $5\frac{1}{2}''$ Strips bolted diagonally so that they also hold the sides of the frame rigid. The transverse Rod is fitted with a $3''$ Pulley Wheel that is driven from the special pulley on the armature spindle of the E1 Motor, bolted in position between the lower pair of Angle Girders.

Parts required for Planing Machine :—2 of No. 2 ; 12 of No. 5 ; 2 of No. 6a ; 4 of No. 8 ; 1 of No. 11 ; 6 of No. 12 ; 1 of No. 16 ; 1 of No. 17 ; 1 of No. 18a ; 2 of No. 19b ; 1 of No. 22 ; 1 of No. 24 ; 4 of No. 35 ; 43 of No. 37 ; 4 of No. 37a ; 2 of No. 38 ; 1 of No. 40 ; 1 of No. 52 ; 2 of No. 54 ; 1 of No. 111c ; 2 of No. 125 ; 2 of No. 126 ; 2 of No. 126a ; No. E1 Electric Motor.

Twin Anti-Aircraft Guns

This realistic model can be built with a No. OO Meccano Outfit, and as will be seen from Fig. 3, is very simple to construct. The base is formed from two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted to a Bush Wheel and a $\frac{3}{8}''$ Bolt gripped in the boss of the Bush Wheel secures two Flat Brackets in position. Angle Brackets are bolted to these and each carry two Angle Brackets to which the guns are secured by means of Spring Clips. Each gun is represented by a $2''$ Axle Rod.

Parts required for Twin Anti-Aircraft Guns :—2 of No. 10 ; 6 of No. 12 ; 2 of No. 17 ; 1 of No. 24 ; 4 of No. 35 ; 8 of No. 37 ; 1 of No. 111c.

Tipping Motor Wagon

Fig. 4 shows a small model Motor Lorry that is fitted with a tipping body. A Flat Trunnion is bolted at one end of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and a second similar part is attached to it by Double Brackets. A Flat Bracket is bolted to the upper part and forms a bearing for a $2''$ Axle Rod carrying the steering wheel, and a Bush Wheel at its lower end which is connected by a length of cord to the front axle. The $3\frac{1}{2}''$ Rod fitted with the front pair of wheels is free to turn in Angle Brackets bolted at each end of a $2\frac{1}{2}''$ Strip that is pivoted at the centre to a Reversed Angle Bracket. The rear axle is journalled in Flat Brackets bolted to the Flanged Plate.

The tipping body is made by bolting a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip at each end of a pair of $5\frac{1}{2}''$ Strips, and the frame so formed is pivoted to Angle Brackets bolted to the Plate. A bottom for the body may be added by cutting out a piece of cardboard to the required size.

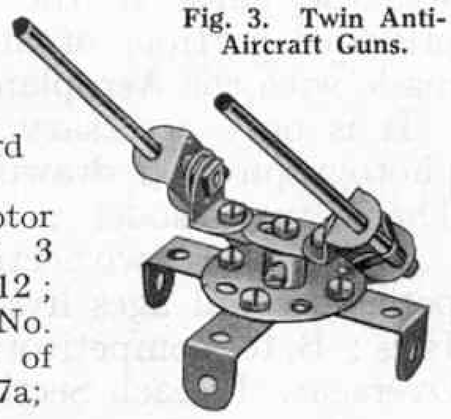


Fig. 3. Twin Anti-Aircraft Guns.

Parts required for Tipping Motor Wagon :—2 of No. 2 ; 1 of No. 5 ; 3 of No. 10 ; 2 of No. 11 ; 5 of No. 12 ; 2 of No. 16 ; 1 of No. 17 ; 4 of No. 22 ; 1 of No. 23 ; 1 of No. 24 ; 2 of No. 35 ; 16 of No. 37 ; 4 of No. 37a;

1 of No. 40 ; 2 of No. 48a ; 1 of No. 52 ; 3 of No. 111c ; 1 of No. 125 ; 2 of No. 126a.

Skimmer Scoop

This type of machine is employed chiefly for digging trenches and for similar excavating work. The travelling base of the model is formed from two $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates connected across their ends by $5\frac{1}{2}''$ Strips. The Axles for the Wheels are carried in pairs of Trunnions and Flat Trunnions, the former being fixed in position by means of Angle Brackets. It will be noticed that a space is left between the two Plates, and the boss of a 3″ Pulley Wheel fits in this, the Pulley being bolted down to the Plates. The No. 2 Clockwork Motor forms the main frame of the superstructure, and rests on the 3″ Pulley Wheel. The method of pivoting the Motor is as follows : Two $3\frac{1}{2}''$ Strips with a $2\frac{1}{2}''$ Strip bolted at right angles between their centres to form an H shaped member are bolted to the Motor so that a Pivot Bolt inserted through the centre hole of the shorter Strip is retained in position. The pivot Bolt is inserted in the boss of the 3″ Pulley and gripped by the Set Screw.

A $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate is bolted at the rear of the upper Motor side plate and has a $5\frac{1}{2}''$ Strip bolted to each of its flanges. These Strips are attached to the front of the Motor by Angle Brackets, and a $3\frac{1}{2}''$ Strip is bolted across their ends by similar means. Two Sector Plates are mounted in position and the " A frames " are made from $5\frac{1}{2}''$ Strips.

The jib is built up from two channel section girders each made up from a pair of $12\frac{1}{2}''$ Angle Girders. The bucket, which is built up from Strips and Double Angle Strips, is provided with four $\frac{3}{4}''$ Flanged Wheels which traverse the upper pair of Angle Girders. The jib is raised and lowered by means of a cord passing over a 1″ loose Pulley at the top of the A frames and wound round the $4\frac{1}{2}''$ Axle Rod 1 journalled in the Sector Plates. The Rod carries a 57-teeth Gear Wheel and also a 2″ Pulley which is provided with a band brake.

The second Rod 2, journalled between the Sector Plates, carries a $\frac{1}{2}''$ Pinion and two Collars, in addition to a 2″ Pulley for a brake. The Collars are secured in position with a space between them to accommodate the shank of a bolt attached to the lever 3, which is pivoted in the second hole from the end to a $1'' \times 1''$ Angle Bracket bolted to the Sector Plate. The Rod 2 carries the dragging cord which passes over a 1″ loose Pulley above the gearbox and round the $1\frac{1}{2}''$ Pulley at the jib head before being tied to the bucket. The Rod 2 is slidable so that the $\frac{1}{2}''$ Pinion can be engaged with a Worm on the Motor driving shaft and also with the 57-teeth Gear on the Rod 1.

The Rod 5, which is also slidable in its bearings operates the slewing movement, and carries the $\frac{1}{2}''$ Pinion 4 and two Collars between which fits the shank of a Bolt at the end of the lever 3. A cord is wound round the end of the Rod outside the Sector Plates and is guided round a horizontal Rod held in Angle Brackets before passing round the 3″ Pulley fixed to the travelling base. The Pinion 4 can be engaged with the Worm on the Driving Shaft.

A $2\frac{1}{2}''$ Braced Girder is pivotally attached to the bucket to form the hinged flap and a $1\frac{1}{2}''$ Strip, pivoted to an Angle Bracket, serves as a catch. A length of cord is tied to the Strip so that by pulling this the contents of the bucket can be released. The Strip is shown on the right-hand side of the bucket in Fig. 5.

Parts required for Skimmer Scoop :—11 of No. 2 ; 5 of No. 3 ; 2 of No. 4 ; 11 of No. 5 ; 1 of No. 6a ; 4 of No. 8 ; 4 of No. 10 ; 2 of No. 11 ; 9 of No. 12 ; 1 of No. 12a ; 2 of No. 15 ; 3 of No. 15a ; 4 of No. 16 ; 2 of No. 18a ; 1 of No. 19b ; 2 of No. 20 ; 4 of No. 20b ; 1 of No. 21 ; 4 of No. 22 ; 2 of No. 22a ; 2 of No. 26 ; 1 of No. 27a ; 1 of No. 32 ; 9 of No. 35 ; 72 of No. 37 ; 11 of No. 37a ; 14 of No. 38 ; 2 of No. 40 ; 2 of No. 48 ; 6 of No. 48a ; 2 of No. 48b ; 3 of No. 53 ; 2 of No. 54 ; 4 of No. 59 ; 2 of No. 62 ; 1 of No. 63 ; 1 of No. 98 ; 6 of No. 111c ; 2 of No. 126 ; 2 of No. 126a ; 1 of No. 147b ; No. 2 Clockwork Motor.

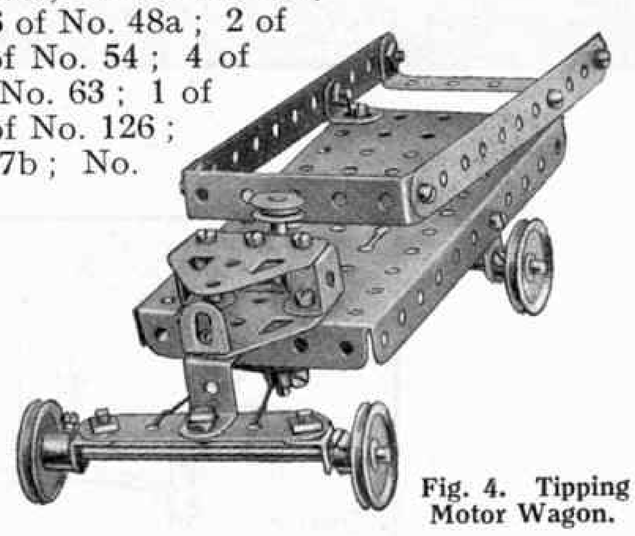
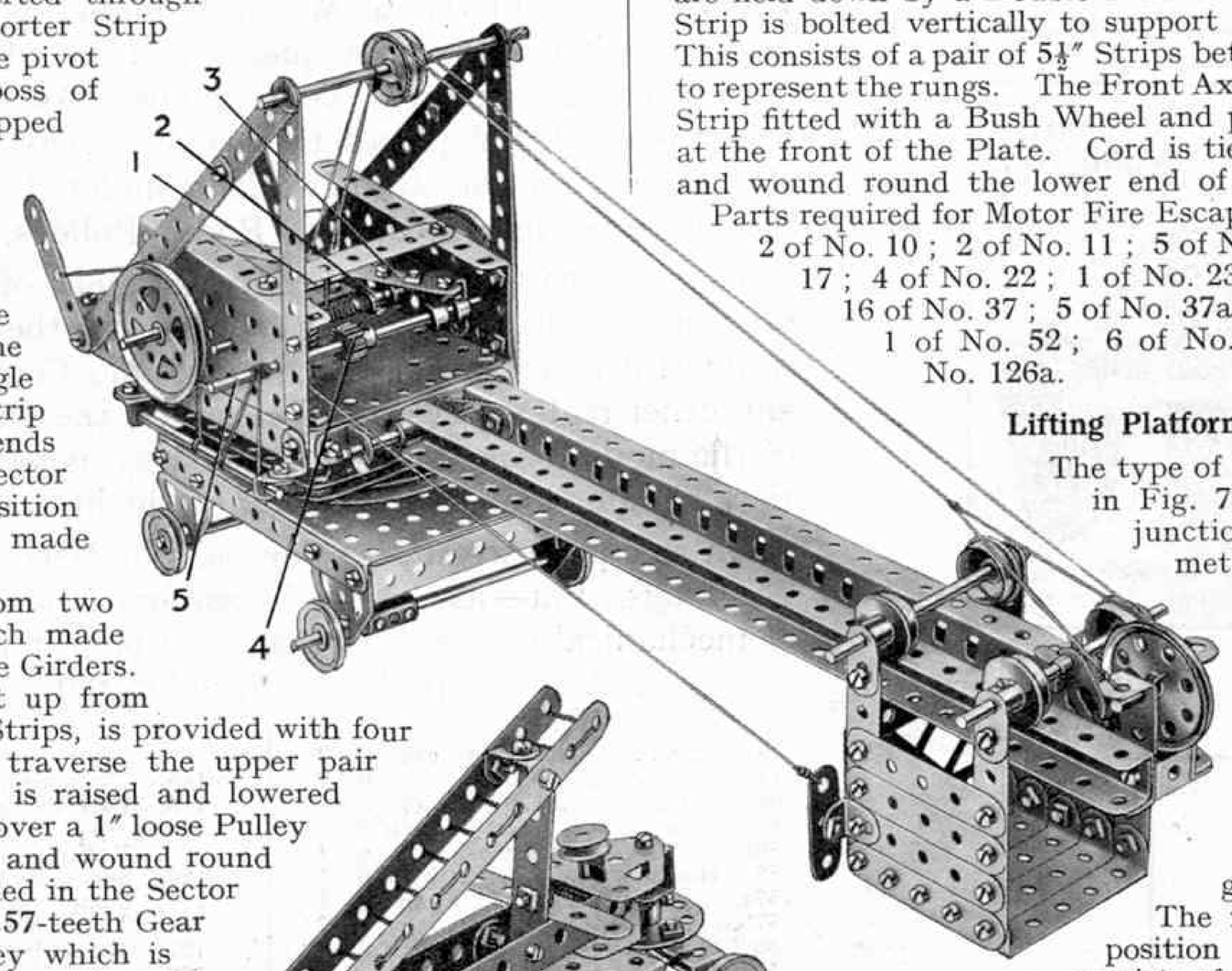


Fig. 4. Tipping Motor Wagon.

Motor Fire Escape

A $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate is fitted with a Flat Trunnion at the front and two Trunnions bolted at the rear carry a pair of $5\frac{1}{2}''$ Strips extending slightly beyond the front of the Plate. The Strips are held down by a Double Bracket and a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is bolted vertically to support the upper end of the ladder. This consists of a pair of $5\frac{1}{2}''$ Strips between which Cord is threaded to represent the rungs. The Front Axle is carried in a Double Angle Strip fitted with a Bush Wheel and pivoted to a $2\frac{1}{2}''$ Strip bolted at the front of the Plate. Cord is tied to the Double Angle Strip and wound round the lower end of the steering Rod.

Parts required for Motor Fire Escape :—4 of No. 2 ; 2 of No. 5 ; 2 of No. 10 ; 2 of No. 11 ; 5 of No. 12 ; 2 of No. 16 ; 1 of No. 17 ; 4 of No. 22 ; 1 of No. 23 ; 1 of No. 24 ; 2 of No. 35 ; 16 of No. 37 ; 5 of No. 37a ; 1 of No. 40 ; 2 of No. 48a ; 1 of No. 52 ; 6 of No. 111c ; 2 of No. 126 ; 2 of No. 126a.



(Top) Fig. 5. Skimmer Scoop. (Left) Fig. 6. Fire Escape.

Lifting Platform Truck

The type of truck depicted in model form in Fig. 7 is intended for use in conjunction with a number of wooden or metal platforms. The platforms are loaded with goods, and when it is required to transport these from one place to another the truck is pushed beneath the platform and the lifting mechanism brought into operation to raise the platform clear of the ground.

The model truck is illustrated in position under the platform, which consists of a pair of angle girders formed from $12\frac{1}{2}''$ Strips and connected by $5\frac{1}{2}''$ Strips. A pair of Flat Trunnions and Trunnions are bolted to the sides, the latter being secured by Angle Brackets.

The body of the truck consists of two separate frames each formed from two $12\frac{1}{2}''$ Angle Girders connected across their ends by Strips spacing them apart $3\frac{1}{2}''$. The frames are connected together so that the upper one can be raised or lowered with a parallel movement. Two $1\frac{1}{2}''$ Strips are used for the connecting links at the rear, and at the front a pair of $2\frac{1}{2}''$ Strips are used, the Girders being pivoted in the first and third holes. The upper holes carry an Axle Rod.

The front wheels of the truck are fixed on a Rod carried in a Cranked Bent Strip, and two $12\frac{1}{2}''$ Strips forming the handle for the truck are also mounted on the Rod. Near the lower end of the handle a $5\frac{1}{2}''$ Strip is pivoted, and Bolts in the end of the Strip can be made to engage the transverse $4\frac{1}{2}''$ Axle Rod at the forward end of the truck. The Strip may be raised out of engagement by means of a length of Cord attached to a pivoted Flat Bracket that is provided with a Threaded Pin for a handle. When the upper frame of the truck is in the raised position it is retained in place by means of a $2\frac{1}{2}''$ Strip pivoted on a Double Bracket and provided with a Bolt, the shank of which engages one of the holes at the front of the frame. The Double Bracket is free on a $1\frac{1}{2}''$ Rod inserted through a second Double Bracket bolted to the front of the truck.

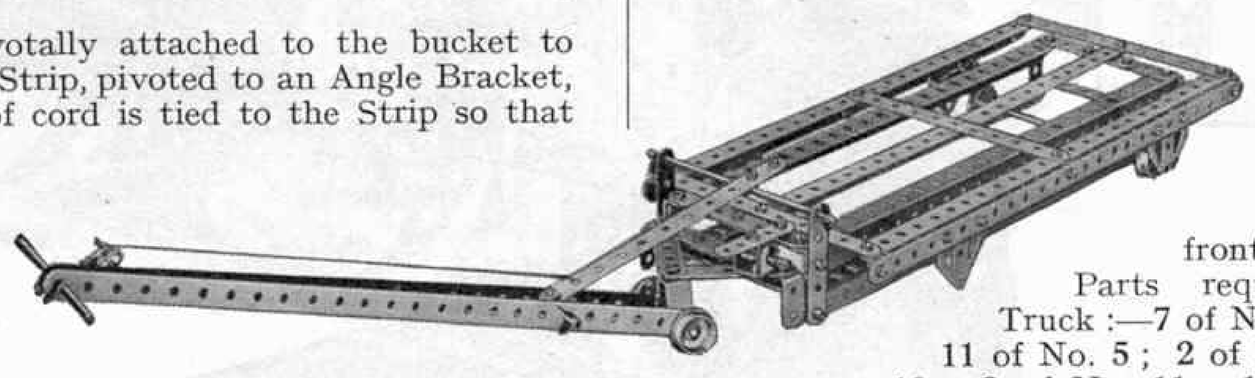
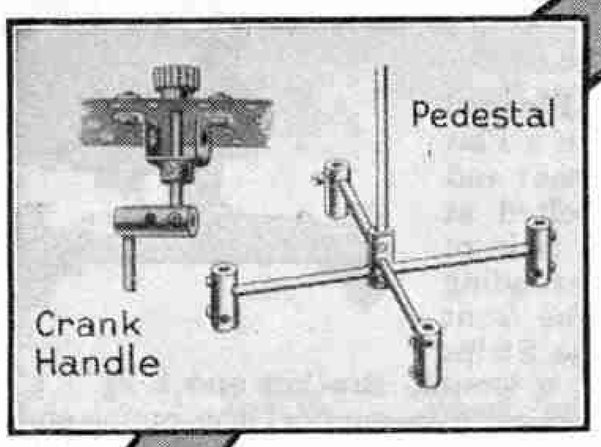
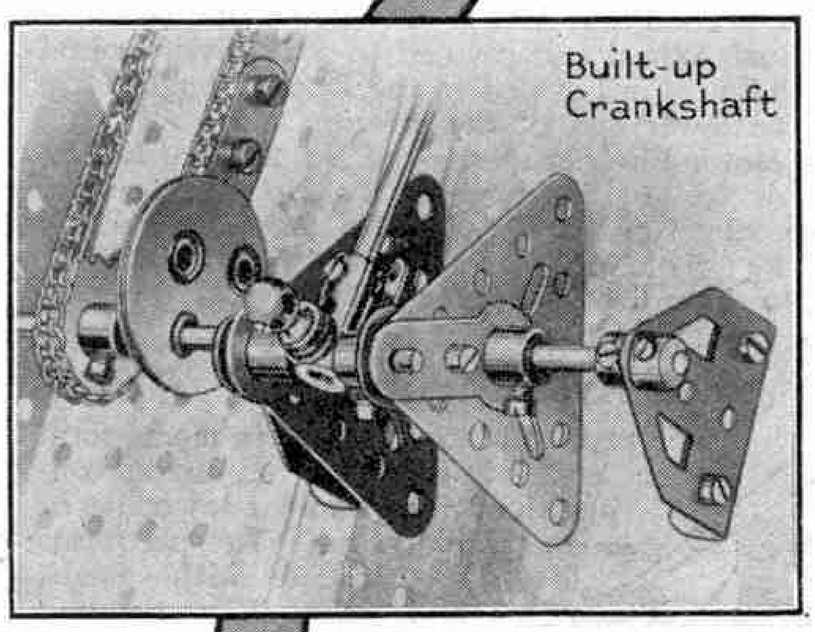


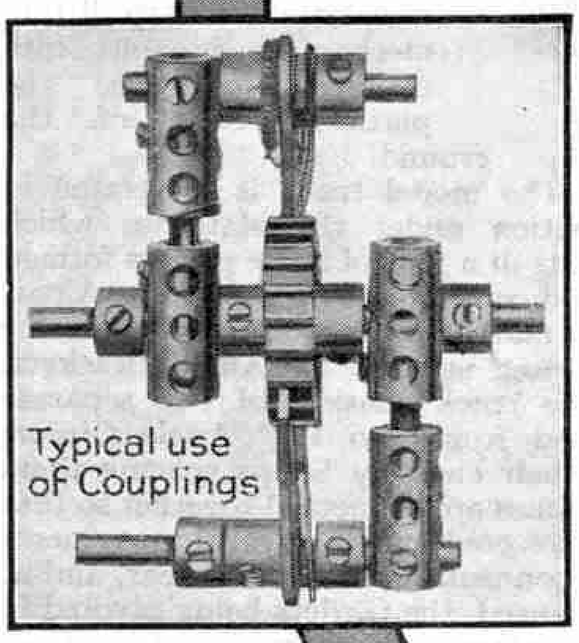
Fig. 7. Lifting Platform Truck.

Parts required for Lifting Platform Truck :—7 of No. 1 ; 4 of No. 2 ; 2 of No. 3 ; 11 of No. 5 ; 2 of No. 6a ; 4 of No. 8 ; 1 of No. 10 ; 3 of No. 11 ; 10 of No. 12 ; 2 of No. 12a ; 1 of No. 15 ; 1 of No. 15a ; 1 of No. 16 ; 2 of No. 18a ; 4 of No. 20b ; 9 of No. 35 ; 56 of No. 37 ; 10 of No. 37a ; 1 of No. 44 ; 1 of No. 111c ; 1 of No. 115 ; 2 of No. 125 ; 2 of No. 126 ; 2 of No. 126a.

MECCANO — ENGINEERING IN MINIATURE









MECCANO PARTS & ACCESSORIES

5. *Cranks, Couplings, etc.*

CONSTRUCTING a Meccano model is a fascinating pastime. Piece by piece, you are able to watch it growing beneath your hands. As the Strips fall into their allotted places the whole structure is gradually strengthened. The framework completed, you add the mechanism—Gears, Cranks, Rods, Pulleys, Cords, etc.

Then comes the most thrilling moment of all, when you set the model in motion. Thanks to the accuracy and wonderful adaptability of the Meccano Couplings, Cranks, and other real engineering accessories, the movable portions of the model begin to function exactly as you had intended they should, and exactly as they do in actual practice.

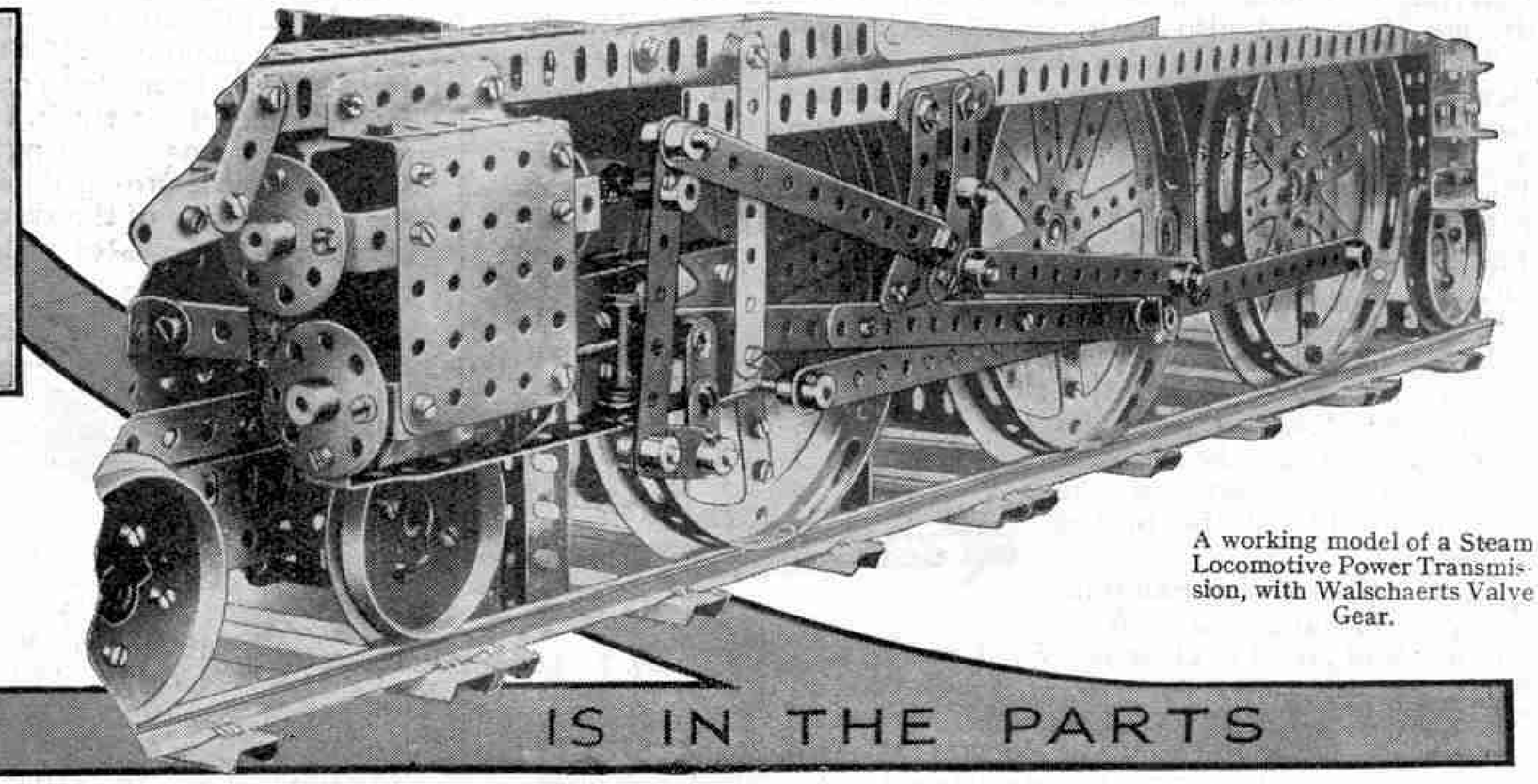
On this page we show a few uses of Meccano Cranks and Couplings, but—as *"M.M."* readers know—the number of mechanical movements that may be obtained with these parts is almost unlimited.

No.			s.	d.
19.	Crank Handles (large)	each	0	2
19s.	„ „ (small)	„	0	2
38.	Washers	doz.	0	1
43.	Springs	each	0	2
50a.	Eye Pieces with boss...	„	0	4
57.	Hooks	2 for	0	1
57a.	„ (scientific) ...	each	0	1
57b.	„ (loaded)	„	0	2
58.	Spring Cord ...per length		0	9
58a.	Coupling Screws for Spring Cord...	per doz.	0	6
59.	Collars with set screws	2 for	0	3
62.	Cranks...	each	0	3
62a.	Threaded Cranks ...	„	0	4
62b.	Double Arm Cranks...	„	0	3
63.	Couplings	„	0	6
63a.	Octagonal Couplings	„	0	8
63b.	Strip Couplings	„	0	8
63c.	Threaded Couplings ...	„	0	6
64.	„ Bosses ...	„	0	2

No.			s.	d.
65.	Centre Forks	each	0	1
115.	Threaded Pins ...	„	0	2
116.	Fork Pieces, large ...	„	0	3
116a.	„ „ small ...	„	0	3
120.	Buffers, for locos, etc.	„	0	2
120a.	Spring Buffers ...	per pair	0	8
120b.	Compression Springs	each	0	1
121.	Train Couplings ...	„	0	2
127.	Simple Bell Cranks	„	0	1
128.	Boss Bell Cranks ...	„	0	3
130.	Eccentrics, Triple Throw	„	1	0
134.	Crank Shafts, 1" stroke	„	0	2
136.	Handrail Supports ...	„	0	3
140.	Universal Couplings	„	0	10
144.	Dog Clutches	„	0	6
165.	Swivel Bearings ...	„	0	6
166.	End „ ...	„	0	3
170.	Eccentrics, ½" throw	„	0	9
171.	Socket Couplings ...	„	0	9
172.	Pendulum Connections	„	0	1

Your dealer will be pleased to show you all the Meccano Parts; ask him for a complete Price List.

MECCANO LTD. - BINNS ROAD - LIVERPOOL 13



A working model of a Steam Locomotive Power Transmission, with Walschaerts Valve Gear.

THE GENIUS IS IN THE PARTS

Model-Building Competition Results

By Frank Hornby

"March" Contest and "Aeroplane Constructor" Contest

"March" Competition

The results of the judging and the allocation of prizes in this Contest are as follows :—

Section A (competitors over 14)

FIRST PRIZE, Cheque for £3-3s. : S. Croft Gray, Edinburgh. SECOND PRIZE, Meccano or Hornby goods value £2-2s. : G. C. Harper, Esq., Uckfield, Sussex. THIRD PRIZE, goods value £1-1s. : B. Graves, Taunton.

SIX PRIZES of Meccano or Hornby goods value 5/– : F. Robison, Monkseaton ; S. Kewney, Monkseaton ; J. Matthews, Fillongley, Nr. Coventry ; G. Shortland, Grimsby ; H. Stephenson, Liverpool ; J. Moses, Acomb, York.

CERTIFICATES OF MERIT : W. Hudson, Weymouth ; F. Robey, Derby ; J. Kings, Rivington, Nr. Bolton ; E. Wiblin, Oxford ; R. Taylor, Blackpool ; E. Whalley, Blackburn ; P. Percy, Hutton, Essex ; R. Lawford, Bexley-heath, Kent ; A. Beecroft, Hull ; A. Lukey, London, N.W.1 ; J. Lowdon, Blaydon-on-Tyne ; J. Struthers, Glasgow ; A. Gardiner, Dorchester ; J. Selden, London, W.6 ; F. Byron, Liverpool ; A. Campbell, Bletchley ; B. Mace, West Bridgford, Notts. ; A. Armstrong, Leicester ; P. Smith, Staines, Middlesex.

Section B (competitors under 14)

FIRST PRIZE, Cheque for £2-2s. : C. Jobson, Dundee. SECOND PRIZE, Meccano or Hornby goods value £1-1s. : N. Unwin, Cambridge. THIRD PRIZE, goods value 10/6 : J. Mellor, Welling, Kent.

SIX PRIZES of Meccano or Hornby goods value 5/– : P. Collins, Billericay, Essex ; J. Broadbent, Shrewsbury ; F. Watkins, London, S.W.17 ; C. Latham, Bristol ; F. Dodgson, Halifax ; R. Lawson, Ashton-on-Mersey.

CERTIFICATES OF MERIT : T. Laity, Plymouth ; S. Webb, Bloxwich, Staffs. ; J. Fisher, Harpenden ; R. Newhouse, Birkenhead ; J. Booth, Rickmansworth, Herts. ; L. Slater, Portsmouth ; J. Laidlaw, St. Boswells ; W. Burrells, London, N.W.9 ; G. Black, London, N.17 ; J. Bell, Liverpool 20 ; G. Askew, London, W.11 ; P. Bradley, London, N.W.9 ; R. Collins-Jones, Birmingham ; C. Owen, Peterborough ; N. Brittan, Newcastle-on-Tyne 4 ; C. Pegler, Cambridge ; D. Carver, Mansfield ; E. Morton, Maidstone ; E. Stockley, Liverpool 11 ; E. Shave, Grays, Essex ; H. Dixon, Carlisle.

Section C (Overseas competitors)

FIRST PRIZE, Cheque for £3-3s. : Gerrit van der Mey, Lisse, Holland. SECOND PRIZE, Meccano or Hornby goods value £2-2s. : H. Eustis, Alberton, South Australia. THIRD PRIZE, goods value £1-1s. : A. Robert, Johannesburg, South Africa.

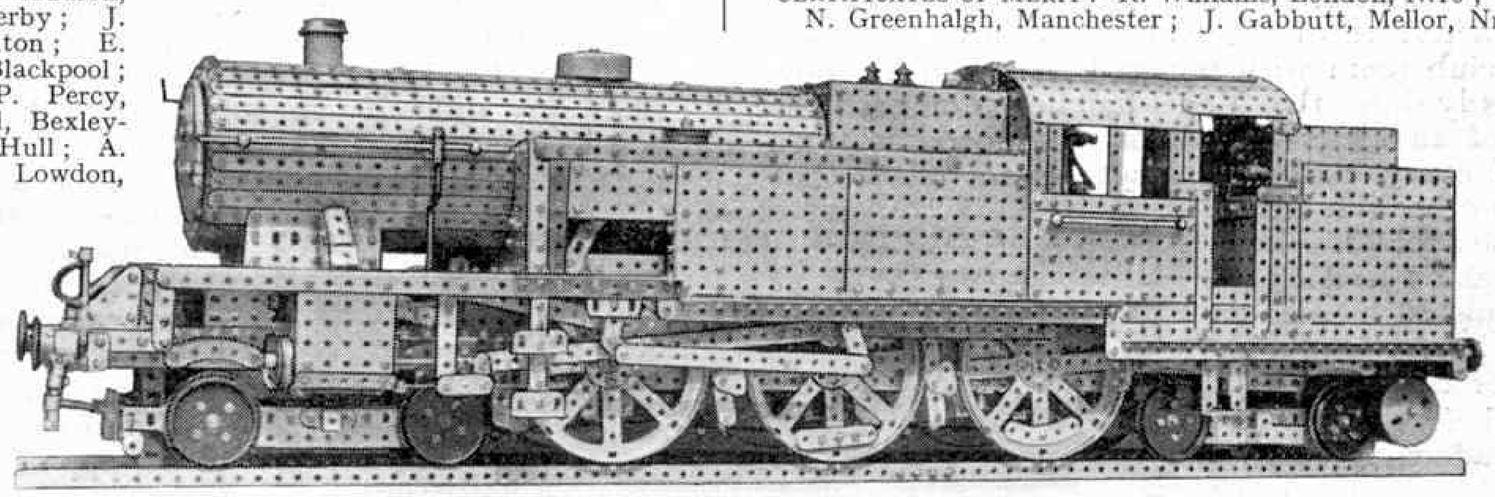
SIX PRIZES of Meccano or Hornby goods value 5/– : P. Giese, Buenos Aires ; A. Ness, Port Dalhousie, Ontario ; K. Landsheer, Nijmegen, Holland ; D. Galliano, Genoa ; G. Marsh, Island of St. Helena ; P. Andersin, Finland.

CERTIFICATES OF MERIT : N. Paola, Durban ; I. Loveridge, Wellington, N.Z. ; R. Helm, Bowral, N.S.W. ; D. Teaze, Wellington, N.Z. ; C. Sadd, Wellington, N.Z. ; K. Orams, Blenheim, N.Z. ; C. Carter, Ontario, Canada ; D. Parker, North Battleford, Saskatchewan ; K. Harvey, Mafeking, S. Africa ; F. Voskuyl, Baarn, Holland.

A model of a 4-cylinder "Baltic" tank locomotive was submitted by S. Croft Gray. The power unit is a Meccano Electric Motor, which is situated in the tender and turns the driven wheels through a three-speed gear box. There is also a booster, by means of which the trailing wheels are driven from the Motor. The purpose of the booster in the case of a real locomotive is to provide rapid acceleration, and also to give extra power on steep inclines. In Gray's model Walschaerts type valve gear is used, and an interesting point is that the inside cylinders are set slightly in front of the outside ones.

C. Johnson, First Prize winner in Section B, was successful with an electric derrick crane.

In the Overseas Section a fine model loom was sent by Gerrit van der Mey, a blind Dutch boy. I intend to describe this model in a future issue of the *"M.M."*



This model 4-cylinder "Baltic" Tank Locomotive won First Prize in the "March" Competition (Section A). It was built by S. Croft Gray, and is complete to the smallest detail, including connecting rods with built-up big ends and a built-up crankshaft.

"Aeroplane Constructor" Contest

The results of the judging and the allocation of prizes in this Contest are as follows :—

Section A (competitors over 12)

FIRST PRIZE, Cheque for £3-3s. : R. Storrar, Letham, Ladybank, Scotland. SECOND PRIZE, Meccano or Hornby goods value £2-2s. : H. Brockett, London, E.6. THIRD PRIZE, goods value £1-1s. : D. Symes, Dawlish, Devon.

SIX PRIZES of Meccano or Hornby goods value 5/– : W. Burrells, London, N.W.9 ; C. Kemp, Guildford ; T. Mullins, Plymouth ; P. Smith, Staines, Middlesex ; A. Parminter, Dawlish, Devon ; A. Akehurst, Lewisham.

CERTIFICATES OF MERIT : R. Williams, London, N.10 ; H. Fowler, London, S.E.10 ; N. Greenhalgh, Manchester ; J. Gabbutt, Mellor, Nr. Blackburn ; K. Andrews, London, S.W.11 ; A. Leeds, Wingate, S.O., Co. Durham, L. Campbell, Fareham, Hants. ; J. Sessions, Penarth, Glam. ; H. Deane, Dundrum, I.F.S. ; D. Couzens, Whitchurch, Glam. ; J. Close, Scarborough ; T. Rutter, Sunderland ; J. Byass, Driffield ; L. Wilkins. Torquay ; H. Wilcock, London, E.4 ; H. Chapman, Egham, Surrey ; J. Jenkinson, Rochdale ; G. Hepburn, Midlothian, Scotland ; N. Cook, Wolverhampton ; K. Benest, London, N.16 ; M. Fairbairn, Peebles, Scotland ; S. Pattinson, London, W.13 ; J. Gammon, Guildford ; T. McDonnell, Ballingarry ; F. Stone, Chard, Somerset ; L. Weighell, Middlesbrough ; A. Clark, London, E.13 ; C. Bates, Derby.

Section B (competitors under 12)

FIRST PRIZE, Cheque for £2-2s. : D. Noverraz, Glasgow, W.3. SECOND PRIZE, Meccano or Hornby goods value £1-1s. : A. Murdock, Bexhill-on-Sea. THIRD PRIZE, goods value 10/6 : F. Calder, London, E.13.

SIX PRIZES of Meccano or Hornby goods value 5/– : N. Harris, Bristol ; G. Brooks, Preston ; J. Ford, Nottingham ; L. Bridgeman, Woodford Green, Essex ; R. Hervey, Bushey Heath, Herts. ; S. White, Reading.

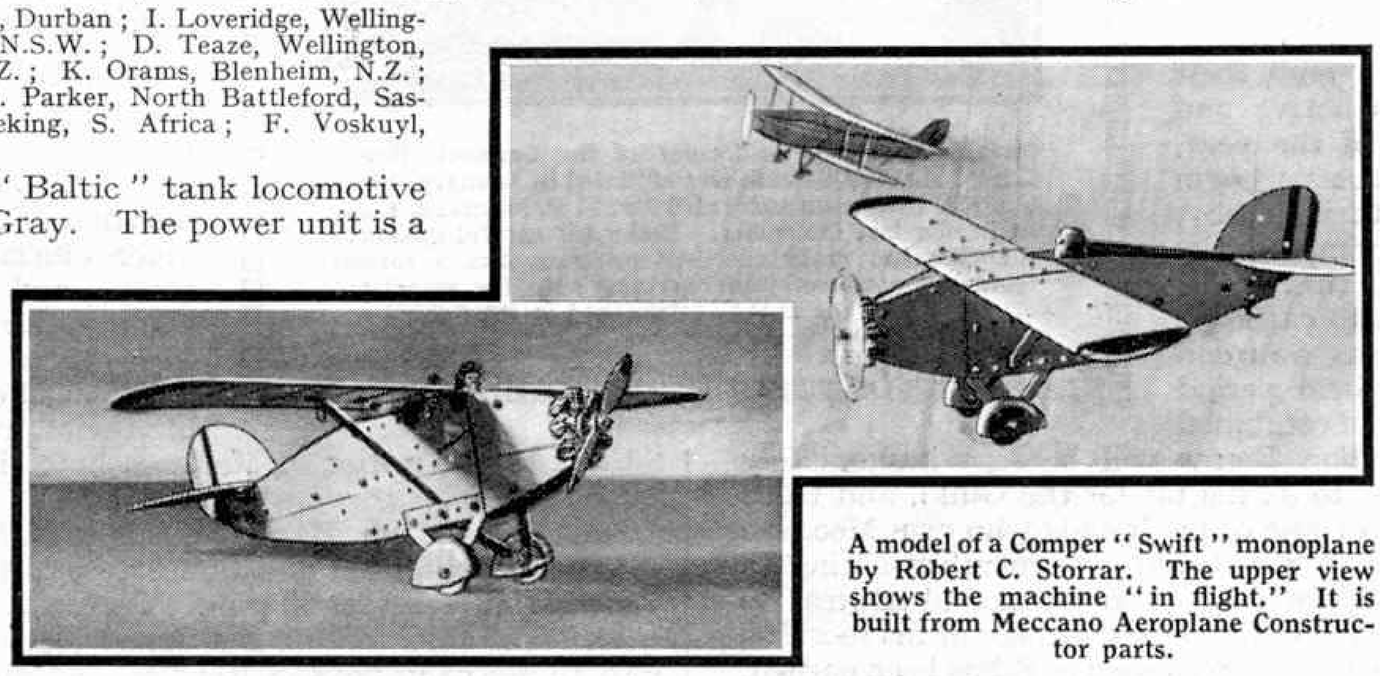
Section C (Overseas competitors)

FIRST PRIZE, Cheque for £3-3s. : N. Tingey, Christchurch, N.Z. SECOND PRIZE, Meccano or Hornby goods value £2-2s. : R. Rasmussen, Bergen, Norway. THIRD PRIZE, goods value £1-1s. : E. Paasche, Bergen, Norway.

SIX PRIZES of Meccano or Hornby goods value 5/– : R. Porter, Brisbane ; H. Jones, Capetown ; W. Jackson, Que Que, S. Rhodesia ; M. Meredith, Montreux, Switzerland ; T. Carlile, Newfoundland ; J. Addison, Middleburg, Cape Province, S.A.

One of Robert C. Storrar's models is illustrated on this page. It is a reproduction of a Comper "Swift," and in one of the illustrations it is shown "in flight." The model is exceptionally neat, and was accompanied by an equally well-built model of a Sikorsky flying boat. First Prize (Section A) was awarded to this competitor, the award being made on the joint merits of his two fine entries.

Donald Noverraz, the First Prize winner in Section B, built a Fokker triplane. This competitor has done remarkably well to win the biggest prize in his Section, for he is only 8 years of age. Well done, Donald ! I shall expect big things of you in future competitions.



A model of a Comper "Swift" monoplane by Robert C. Storrar. The upper view shows the machine "in flight." It is built from Meccano Aeroplane Constructor parts.

The Boulton and Paul "Sidestrand" twin-engined day bomber was featured by Noel Tingey, Christchurch, N.Z. The engines are joined to the wings by two of part No. P30, Float and Centre Section Strut, and similar parts are used for fixing the wheel axle to the underside of the lower wing.

One of the entries in Section A was a Handley Page "P.38" twin-engined night bomber. This was submitted by D. F. Symes, and consists of a large type Fuselage, with

(Continued on page 794)



A Season of Changes

In the northern hemisphere, holidays and the recognised outdoor season are now definitely at an end, and clubs are settling down to the normal activities of the winter sessions. Members are returning to the club room with renewed zeal, and are now entering whole-heartedly into the Model-building Competitions and indoor contests of all kinds that form the central features of the programme of every club. It is curious to reflect that their comrades on the other side of the world are reversing the process. Clubs in Australia, New Zealand and South Africa have just completed a splendid winter's work, and have thoroughly earned the good times they will have in the summer days before them.

In this country Leaders, secretaries and club members alike seem to be brimming over with new ideas for the coming winter sessions, and I shall look forward with interest to news of the working of these in practice. I hope that full details of popular new features for meetings of all kinds will be forwarded to me as soon as possible. One of the most gratifying signs of the Guild spirit in club work is the readiness with which new ideas are shared, and I would like to remind those in search of variety of the value of the "*Club Notes*" page. The reports appearing in it show what is being done in other clubs, and I shall always be pleased to amplify the brief accounts often included in it of novel forms of meeting.

Recruits for the Guild

Last month I emphasised the necessity for recruiting efforts, and their influence in keeping clubs active and enterprising. This period of the year, when many Meccano enthusiasts begin to devote more time to their hobby, is an excellent time for gaining recruits for the Guild, and I hope that every member will do his utmost to earn one of the Recruiting Medallions awarded for securing three recruits in a period of three months. A supply of combined Guild Leaflets and Application Forms will be sent immediately to any member who is eager to do his bit for the Guild, and these should be distributed among those of his friends who own Meccano Outfits and are likely to join the Guild. A member acting in this manner must not forget to write his own name and address on each form, in order that I may be able to keep track of his recruits, and award him a Recruiting Medallion as soon as it has been earned.

For the benefit of those who have not previously made efforts to spread the influence of the Guild in this manner, I wish to point out that further success in recruiting is recognised by the engraving of the enthusiast's name on his medallion when he has recruited three more new members, making six in all. Those who secure their first recruit now will have until Christmas to earn a Recruiting Medallion, and must bring their totals to six before the end of March next year in order to qualify for the higher award.

Meccano Club Leaders

No. 68. Mr. R. Brownson



Mr. R. Brownson is Leader of the Cannock House School M.C. This club was affiliated in January, 1932, and Mr. Brownson succeeded Mr. F. P. Montagu, B.A., as Leader last December. Under his careful guidance the club has made excellent progress, and a special feature is made of joint working with the associated Branch of the H.R.C. established in the School.

How Meccano Clubs are Formed

The full benefit of membership of the Meccano Guild can only be attained by joining a Meccano club, and the first step of every new member therefore should be to get into communication with the Leader or Secretary of the one nearest to him. If he finds any difficulty in this respect, he should write to me for a list of suitable clubs.

In certain cases there may not be a club within a reasonable distance of the new member's home, and the recruit then should consider the possibility of forming one. This is by no means a formidable undertaking. Except in special cases, the largest Meccano clubs began in a small way, and most of them trace their beginning to the meeting in their own homes of a few enthusiasts, who realised the advantages of pooling ideas and sharing the fun and enjoyment to be derived from their hobby.

There is to-day a very large number of small clubs of this kind, and I hope that others will be formed during the coming winter sessions. Some of them may be formed in sparsely populated districts, where opportunities of securing recruits are limited. Others, more favourably placed in this respect, will grow steadily until they rival the splendid organisations whose activities are reported regularly on the "*Club Notes*" page. The Guild spirit can be effectively displayed in all of them, whether large or small, and I shall be greatly interested in their progress.

Clubs Not Yet Affiliated

Another point of importance in this connection is that the "*Club Notes*" page is not intended only for affiliated clubs. I am always glad to include mention of clubs that have not yet been given official recognition, whatever the cause, and I hope that during the coming session I shall hear regularly from those who guide their fortunes.

This will enable me to include reports of their progress and thus to bring them to the notice of Meccano boys living in the neighbourhood.

* * * * *

The Anderson Baptist (Reading) M.C. is holding its Second Annual Exhibition and Concert on 25th October, in the Anderson Memorial Hall at 6.30 p.m. The price of admission is 4d., children 2d. The chief feature is a Grand Model-building Competition open to all Meccano boys in Reading and district, and entry forms may be obtained from Mr. R. E. Hoffler, 27, Pitcroft Avenue, Reading.

Proposed Clubs

BRISTOL—J. Martin, 60, St. Werburgh's Park, Mina Road.
CONISBOROUGH—Kenneth Dunn, 32, Old Road.
HOLLAND—C. Lazendijk, Vondellaan 29 B, Schiedam (West).
LOUGHBOROUGH—A. P. Price, "The Firs," Narrow Lane, Hathern.
NEW ZEALAND—L. Tong, Southbridge, Canterbury, New Zealand.



Exeter M.C.—The Club's large workshop models continue to grow, a second storey having been added to one of them. Among the machines included are drills, power presses, cutting machines, ventilating fans, all based on originals in the Gas Engineering Works at Exeter. Meters built of Meccano parts record the number of revolutions of the driving engines. The interest of members is concentrated by work on the two workshop models, which are very realistic in action, and can be worked in conjunction with operations on the Club's Hornby Train layout. Club roll: 37. *Secretary:* D. Legg, 25, Chute Street, Exeter.

Mall School M.C.—Outdoor games have been chief recent events, and these have been varied by visits to the Zoo and to Oxshott Woods. Model-building Contests have been held when outdoor meetings were impossible, and a Hornby Speed Boat Night was a special attraction. Club roll: 33. *Secretary:* K. Rubin, Mendin Lodge, Clifden Road, Twickenham, Middx.

Old Charlton M.C.—Mock trials and Model-building Contests were the chief features of recent indoor work. All meetings in August were held outdoors and included a swimming evening, a sports meeting, and visits to the local Fire Brigade Headquarters and the Docks. A treasure hunt provided great excitement, and Games Evenings also have been thoroughly enjoyed. Club roll; 21. *Secretary:* B. Stevens, 53, Mount Street, Charlton, London, S.E.7.

New Bradwell M.C.—A special summer programme has included cricket and other outdoor games. The cricket team was not very successful in its first efforts, but did better after settling down. A camping holiday also was arranged. Indoor meetings have been devoted chiefly to Table Tennis, Bagatelle and other games. Membership has increased in a very satisfactory manner. Club roll: 41. *Secretary:* R. Bellchambers, 29, King Edward Street, New Bradwell, Bletchley, Bucks.

Whitgift School M.C.—During the summer months the Meccano Club and the associated branch of the H.R.C. held successful joint meetings. A library has been started, and this is to be developed during the coming winter sessions. Enjoyable visits have been paid to Croydon Fire Station and the "*Star*" Printing Works, and also to Cadby Hall, where the sampling of ice-cream and other products was conscientiously carried out! The offices of the "*Daily News*" also have been visited, and there members were greatly interested in the linotype machines, all receiving slugs on which were their names and that of the school. Club roll: 51. *Secretary:* M. M. Young, "The Corrie," Manor Way, Purley, Surrey.

Harlesden Methodist M.C.—Mr. Weightman, Leader of the Club, and several members prepared a side-show for the Harlesden Methodist Tennis Club's Fete. Fairground models were the chief attraction, and an original designing machine aroused great interest. The display gained several new members for the Club. Club roll: 6. *Secretary:* J. Ford, 139, Wakeman Road, Kensal Rise, London.

Dagenham M.C.—The Club has been divided into separate sections for senior boys, junior boys and girls, each under its own Group Leader. A model workshop in which the machines are driven by clockwork has been built by members, and electrical talks are being given. An experimental Hornby Railway has been laid down and operations on it add greatly to the enjoyment of members. During the summer all meetings ended with games and music. More members are required, and the Secretary would be pleased to hear from Meccano boys wishing to join the Club. Club roll: 40. *Secretary:* S. Pashley, 84, Holgate Road, Dagenham, Essex.

Chertsey M.C.—Several successful sports meetings have been held, in addition to Visits, including one to the Eastleigh Works of the S.R. An interesting summer programme of cricket and outdoor games ended a successful year's work. Mr. L. Martland is unfortunately unable to continue as Joint Leader, but an excellent programme has been arranged for the winter sessions under the leadership of Mr. J. Brown. Club roll: 14. *Secretary:* V. Brown, Arbon Grove Cottage, Lyne, Chertsey.

Millwall Central School M.C.—Excellent progress is being made, and specially interesting meetings followed affiliation to the Guild. A lecture on "*The Manufacture of Electric Lamp Bulbs*" was given by Mr. C. B. Bending, Leader of the Club, and other similar events have included papers on "*Diesel-Electric Traction on the L.M.S.R.*" and "*The Port of Glasgow*," read by members of the club. Model-building Contests take the form of Contractors' Nights, members working in sections, or gangs, and the subjects have included the building of cranes and of docks and dock accessories. Club roll: 14. *Leader:* Mr. C. B. Bending, 114, Tressillian Road, Brockley, London, S.E.4.

Bridport Grammar School M.C.—The enthusiasm of members for Meccano model-building is increasing, and a large Meccano Outfit has been obtained, from which members may borrow parts that they require in order to build models. The Library is being overhauled, and during the coming session a special feature will be Lantern Lectures. Club roll: 33. *Secretary:* E. Wilkins, 76, St. Andrew's Road, Bridport.



A jolly group of members of the Ipswich M.C. at their Annual Camp at Aldeburgh. A successful concert was given by members during their stay under canvas, and our photograph includes members of the orchestra that helped to make this enjoyable.

Colwyn Bay M.C.—The Club room is fitted with electric light and water is laid on, while a bench equipped with a vice is provided to help members in constructional work. Every member specialises in a hobby other than Meccano, and the club includes an electrician, a carpenter, a photographer and a chemist, all of whom place their services at the disposal of other members. Special models are being built and other preparations made for an Exhibition at Christmas. Club roll: 8. *Secretary:* J. Thomas, Summer Seat, Conway Road, Colwyn Bay.

Erith M.C.—Affiliation has now been secured and members are very enthusiastic. The club meets at 6 p.m. on Saturday evenings, and those wishing to join should make application to the secretary. A large library is available for members, and woodwork tools have been purchased in order to enable accessories to be made for the club's Hornby Train layout. Meetings are to be devoted chiefly to Model-building, but other hobbies are being introduced. Club roll: 35. *Leader:* Mr. M. A. Ellison, 104, Federation Road, Abbey Wood, S.E.2.

Balham Grammar School M.C.—This club has now secured affiliation to the Guild, and has made an excellent beginning. Meetings are being held weekly and are devoted to Model-building Competitions, Lectures and Talks. Visits also form part of the programme, and members have already inspected the exhibits in the Science Museum, South Kensington. Club roll: 35. *Secretary:* L. R. Sharpe, Balham Grammar School, High Road, S.W.17.

ARGENTINA

Montevideo M.C.—This club is now in its second year and holds meetings twice weekly. Recently members built models for display at an Exhibition, to which Messrs. Coates & Co. kindly contributed several working super models. The Exhibition was open for a week and created great interest among the many visitors. Members demonstrated the working of their models, which included a Vertical Saw, a Well Drilling Machine, Aeroplanes, Cranes and Motor Cars. Club roll: 14. *Secretary:* H. Canziani B, Asociacion Cristiana de Calle Colonia esq. Rio Negro, Montevideo, Uruguay, S. America.

CANADA

Rosemount (Montreal) M.C.—Summer meetings have been held out of doors, and have included picnics and motor drives to places of interest. Members inspected H.M.S. "*Norfolk*" on the visit of this vessel to Montreal, and took part in the welcome accorded to the Italian seaplanes under the command of Marshal Balbo, when the machines alighted at Montreal. At indoor meetings model-building is popular, and films, including some showing activities of members are exhibited by Mr. E. A. Rawlings, Leader of the club. Club roll: 14. *Secretary:* J. Searle, 5850, 5th Avenue, Rosemount, Montreal, Canada.

CHINA

Kowloon (Hong Kong) M.C.—The club meetings were first held weekly, but these were so enjoyable that members now meet twice every week. On Model-building Evenings cranes, battleships and a splendid Meccano clock have been constructed. Games evenings are held at regular intervals, and the birthday of Mr. F. Sellwood, Leader of the club, was celebrated by a social evening. Club roll: 7. *Secretary:* L. A. Sanch, 238, Nathan Road, Kowloon, Hong Kong, China.

NEW ZEALAND

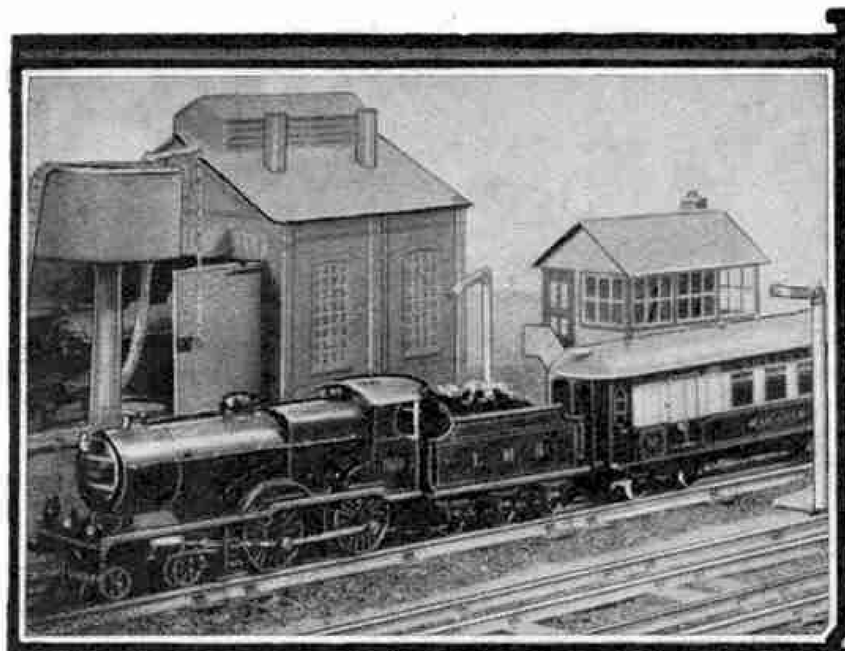
Blenheim M.C.—A visit to a new road under construction was combined with a long ramble over the hills in cold but invigorating weather, and a railway tunnel and various railway accessories were inspected. Indoor Model-building Competitions and other contests continue to attract interest. Club roll: 20. *Secretary:* K. J. Orams, Redwood Street, Blenheim, New Zealand.

Christchurch M.C.—An interesting feature has been the large number of entries in the Model-Building Contests arranged for recent meetings. These have been of very high standard. Lectures have been given on "*Iron and Steel*," by the Manager of the Acetone Welding Company, and on "*Train Control*," by one of the staff of the Christchurch Railway Depot. Club roll: 40. *Secretary:* J. E. Fleming, 52, Cowlishaw Street, Avonside, Christchurch, New Zealand.

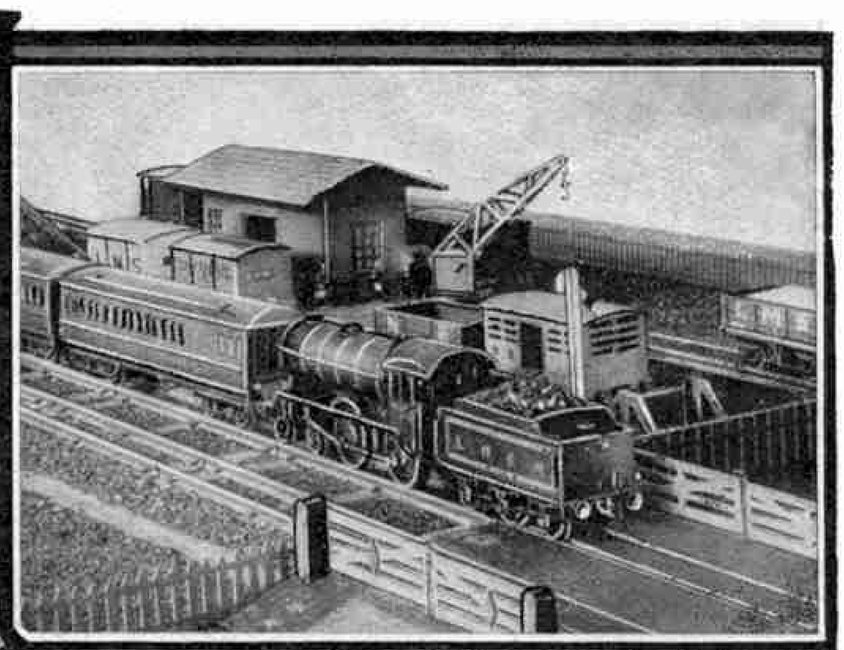
Wellington Boy's Institute M.C.—A Stamp Collecting section has been formed and Table Tennis introduced as an indoor game. Handball is the game chiefly enjoyed, every meeting concluding with a short period devoted to it. The Club's Meccano and Hornby Train material has been cleaned and sorted after the recent successful exhibition, in readiness for further interesting work. Club roll: 18. *Secretary:* A. Abel, 17, Nelson Street, Brooklyn, Wellington, New Zealand.

SOUTH AFRICA

Western Province Preparatory School M.C.—The work of the Club has been extended to include Talks and Visits in addition to Model-building Evenings and Debates. Two very successful Debates have been arranged. In one of these the advocates of electricity for power purposes defeated the champions of steam, and in the other aeroplanes were voted more useful for air transport than airships. There is keen competition in the Model-building Contests and the entries show gratifying improvement in originality. Club roll: 50. *Secretary:* B. B. Strickland, "Engwood," Doris Road, Claremont, Cape, South Africa.



HOW TO GET MORE FUN FROM HORNBY TRAINS



LX.—G.W.R. TRAIN WORKING

NUMEROUS articles have appeared in these pages dealing with characteristic features of train operation based on the practice of various groups. This month, following the recent L.M.S.R., L.N.E.R., and S.R. articles, we shall consider various phases of G.W.R. working, and their application to Hornby railways based on that system.

The Great Western is an extremely individual railway, the original company of that title having preserved its identity through the reorganisation of the grouping period. It absorbed various Welsh railways and has impressed its character upon them, so that the G.W.R. of today retains the features of the original system, with of course up-to-date developments.



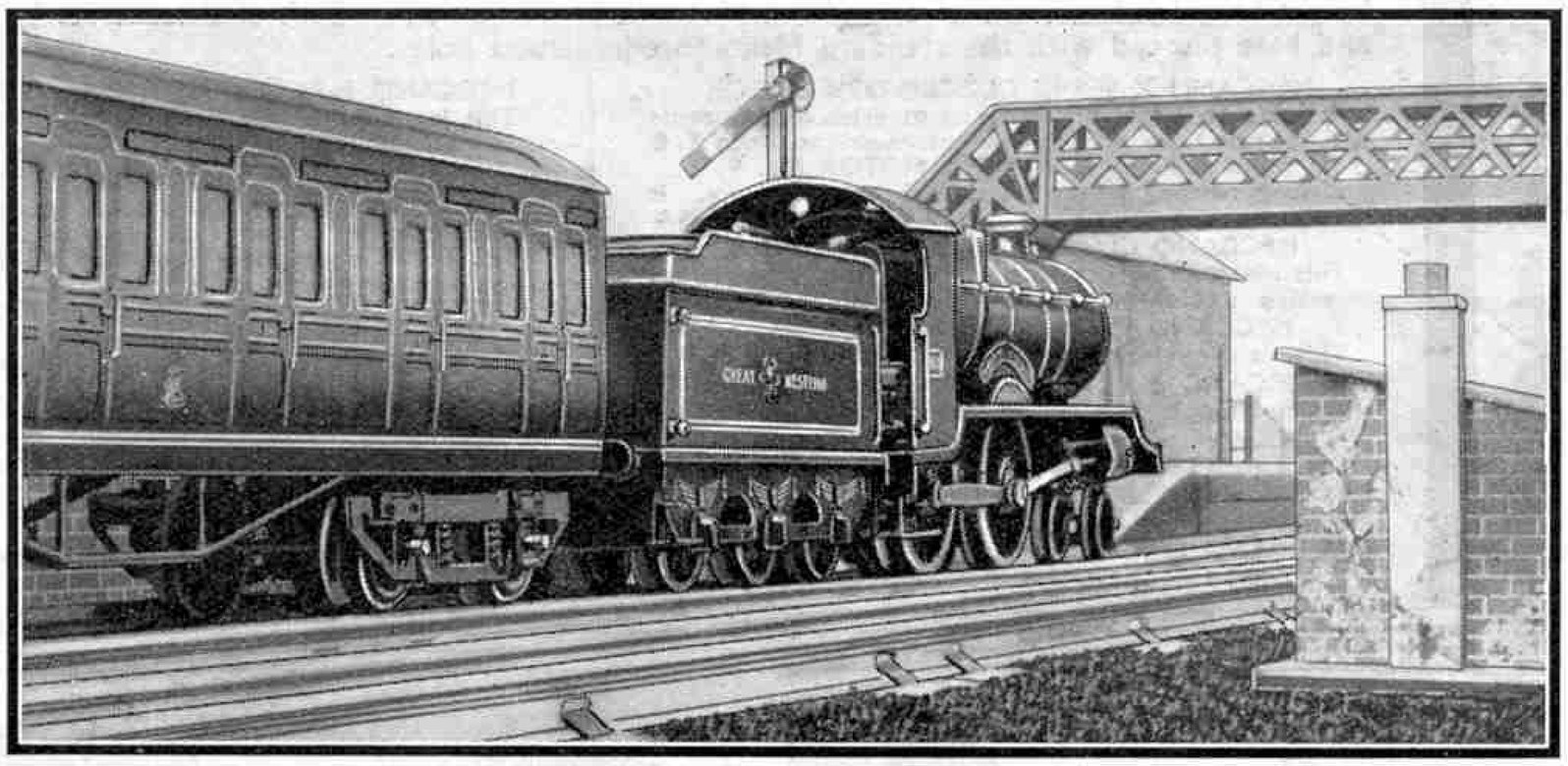
A Hornby Express at speed, representing the G.W.R. "Cheltenham Flyer." The locomotive, a No. 2 Special, embodies many features that are characteristic of Swindon design.

It will be remembered that the original G.W. main line from London to Bristol, its extensions and various associated lines, were laid with broad gauge track, 7 ft. $0\frac{1}{4}$ in. as compared with the standard 4 ft. $8\frac{1}{2}$ in. The effect of this, since the standard gauge finally superseded the broad gauge in 1892, has been that many parts of the system appear to be arranged in a very spacious manner, for the original width between platform faces has been retained. Up and down tracks are thus farther apart than is generally the case elsewhere. In miniature, therefore, double track layouts formed of two single lines of Hornby rails will represent this feature very well. Often such a layout has grown up from the original single track system, which has been developed to double track as additional rails and points have been purchased. This very wide "6-ft. way" on the G.W.R. makes it possible to place signal posts between the tracks, which is useful at times, and particularly so when the driver is posted on the right-hand side of the locomotive, as is the invariable G.W.R. practice. In miniature it is an advantage to be able to place signals in this manner when, as often happens, lineside space is severely restricted.

Turning to the locomotive department, Swindon engines have long been notable for their domeless boilers, on which are mounted the safety valves housed in a neat brass casing. All Hornby Locomotives in G.W.R. colours are therefore similarly fitted. In addition, the two most elaborate models, the "*Caerphilly Castle*" and the "*County of Bedford*" locomotives have Belpaire fireboxes, and their tenders are true-to-type reproductions, with very neat internal fittings, of the 4,000 - gallon vehicles fitted to all the larger G.W.R. express engines.

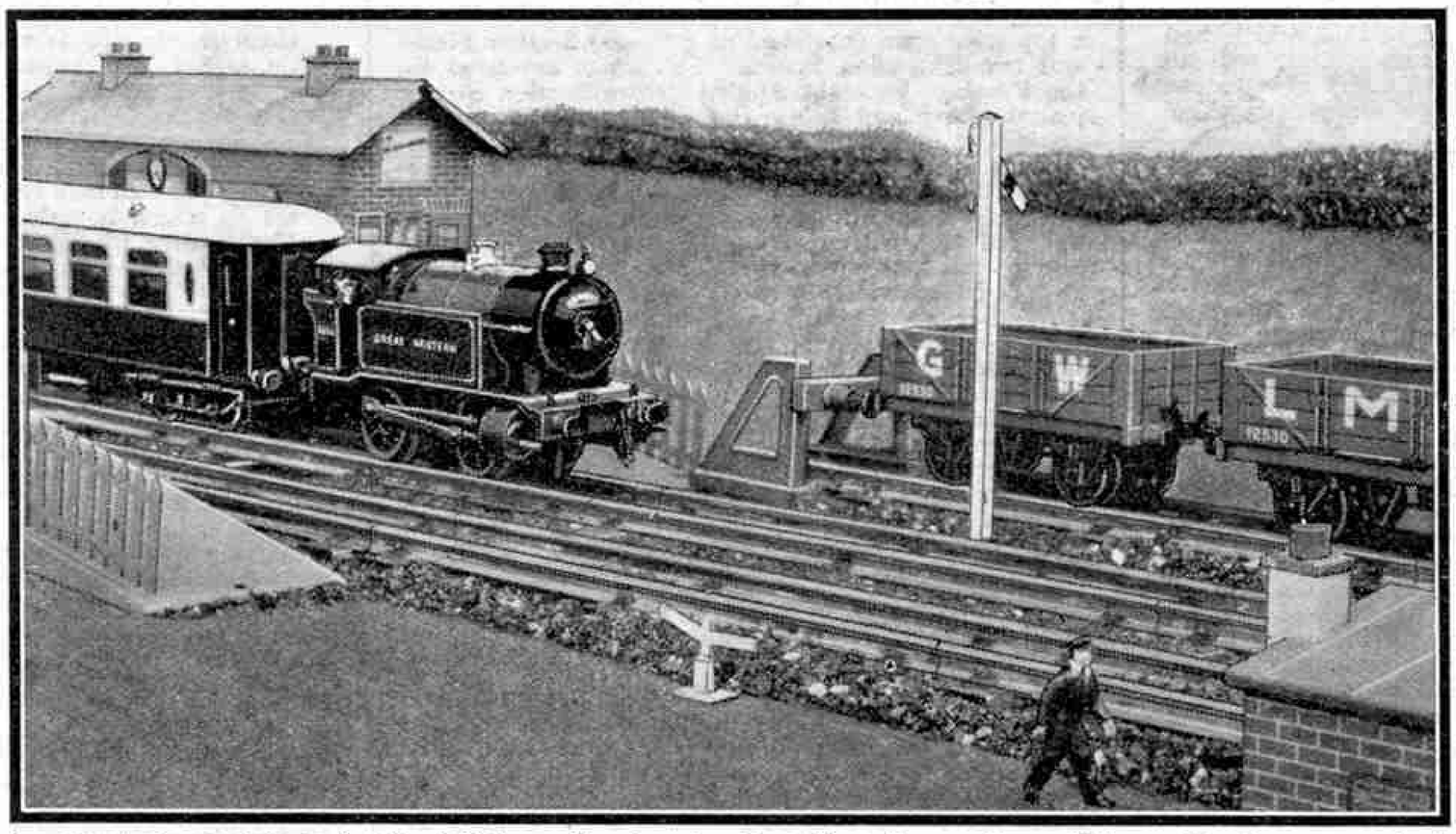
For express trains, therefore, whether of the long distance type represented by the "*Cornish Riviera Express*," or those that travel faster, though over shorter distances, such as the "*Cheltenham Flyer*," the Hornby No. 3 Clockwork or Electric Locomotives, or the No. 2 Special Locomotives are very well suited. The remaining Hornby Locomotives finished in G.W.R. colours incorporate many of the characteristics of the real Swindon productions. The "Halls" of actual practice, that are extremely useful for secondary passenger and express goods work, have as their miniature representatives the No. 1 Special Tender Locomotives. The outside-cylinder No. 1 Tender Locomotive can be used in the same manner as the real Swindon 2–6–0s, and the inside-cylinder No. O Locomotive bears the same relation to it as the actual "2251" 0–6–0 engines do to the "Moguls." Medium-weight passenger or goods work on main or branch lines is the special provinces of both these classes. The miniature engines mentioned are as useful on a model layout as the full-sized ones are in their sphere.

The compact design of G.W.R. Tanks is a particular point of resemblance when the various tank locomotives of the Hornby Series are considered. All of them are suited to their duties according to their sizes and capacity. The M3 and No. 1 Tanks are powerful for their size, like the 0–4–2 and small 2–6–2 G.W.R. tank engines; and, as in their case, local and branch work, goods or passenger, forms their principal duty. One of our photographs shows a No. 1 Tank operating a motor train consisting of one No. 2 Pullman Coach, as suggested recently in the article on branch line working in the June "*M.M.*" of this year. This Coach resembles the large G.W.R. vehicles often used for such work.



Joint working on a miniature Great Western system. A through train of Hornby Metropolitan Coaches representing L.N.E.R. stock is being hauled by a G.W.R. locomotive.

In the making up of representative G.W.R. main line trains with Hornby components it is not difficult to secure the correct effects, although bogie stock for this line is not available. Swindon coaches have so many characteristic features that a true-to-type train in miniature would be expensive, and it is therefore considered preferable by most enthusiasts to use the standard vehicles of the Series. The brown and cream livery used on G.W.R. stock is very closely approached by the colours of Hornby Pullmans, so that their employment is an obvious suggestion. Of course where a miniature G.W. system perpetuates the running of the former "*Torquay Pullman Limited*," and the inclusion of Pullmans in Plymouth boat trains, their use is essential. Lines that do not boast No. 2 Special stock will have to use No. 1 Guard's Vans for luggage accommodation, and although they are four-wheelers, they do not look out of place on a model system when running in conjunction with the bogie No. 2 Pullmans. They can be adapted to carry Train Nameboards with No. 2S Roof Clips, as pointed out in the "*M.M.*" in August last, but they cannot be connected with corridor gangways to the rest of the train.



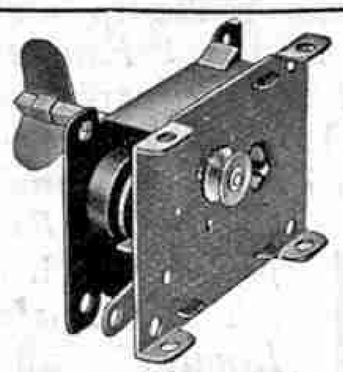
A motor train consisting of a No. 2 Pullman Coach and a No. 1 Tank Locomotive. This combination represents in a realistic manner the motor train units commonly used on the G.W.R. in actual practice.

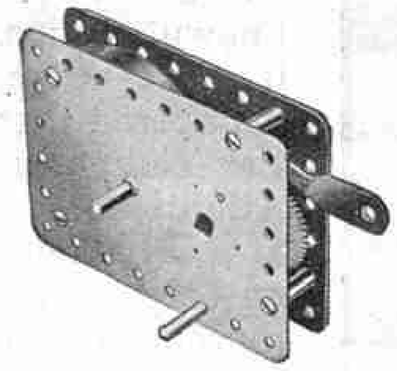
There is no need to say a great deal about the chief services, for we have referred to particular items on several occasions. Descriptions of the make-up and running of certain trains appeared in the "*Famous Trains*" Series of articles in the "*M.M.*" some years ago, as well as in the book of that name. In addition to the usual West Country traffic dealt with by the "*Cornish Riviera Express*," the "*Torbay Limited*," and other well-known trains, it must be remembered that the calling of Atlantic liners at Plymouth on the home journey necessitates the running of special trains up to London. These frequently cover non-stop the distance between Plymouth and Paddington in a little over "even time."

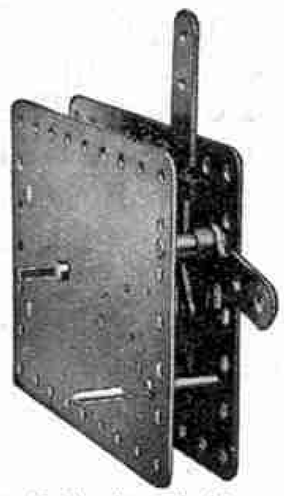
Another variety of boat traffic is that handled at Weymouth, where the G.W.R. steamers on the Channel Islands service are accommodated. This traffic is dealt with by such trains as the "*Channel Islands Boat Express*," and this of course makes quite an imposing title for a miniature train. Such services as these are particularly interesting on model layouts, owing to the "quayside" effects that are possible where space permits. While on this subject we must not overlook the Fishguard steamer and train services. The trains in the course of their long journey negotiate the Severn Tunnel, which should, if possible, be a feature of a miniature railway upon which South Wales or Fishguard boat trains are run.

G.W.R. through services in connection with other railways are interesting, and should not be neglected by those who wish to make the running of their trains as true to actual practice as possible. To give a few instances, Birkenhead and Bournemouth are linked by G.W.R. and S.R. joint services, the exchange point being Oxford; and the West of England generally, and many towns and cities in the North, are served by jointly-operated trains such as "*The Devonian*" of the L.M.S.R., which passes to the G.W.R. at Bristol. Then there is the famous

(*Continued on page 824*)


X Series Clockwork Motor


No. 1 Clockwork Motor


No. 2 Clockwork Motor

MECCANO

POWER UNITS—FOR DRIVING MODELS

In order to obtain the greatest possible enjoyment from the Meccano hobby, the models must be set to work by means of one of the Meccano power units. Each of these units has side plates and base pierced with the standard Meccano equidistant holes.

MECCANO X SERIES CLOCKWORK MOTOR
A fine motor specially designed to drive models made with the new X Series parts. It is non-reversing. Price **2/6**

MECCANO CLOCKWORK MOTOR No. 1
A long running motor fitted with a brake lever. It is non-reversing ... ... Price **5/–**

MECCANO CLOCKWORK MOTOR No. 1a
This motor is similar to the No. 1 Motor, but it has reversing motion ... ... Price **7/6**

MECCANO CLOCKWORK MOTOR No. 2
This is a reversing motor of super quality ... Price **10/–**

MECCANO ELECTRIC MOTOR No. E1 (6-Volt)
A non-reversing electric motor ... ... Price **9/–**

MECCANO ELECTRIC MOTOR No. E6 (6-Volt)
Fitted with reversing motion ... ... Price **15/6**

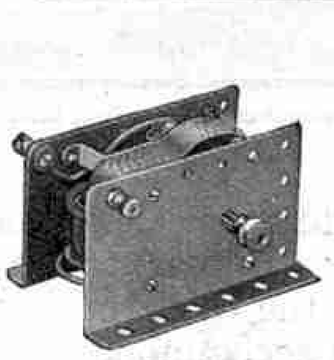
MECCANO ELECTRIC MOTOR E1/20 (20-Volt)
A non-reversing electric motor ... ... Price **10/–**

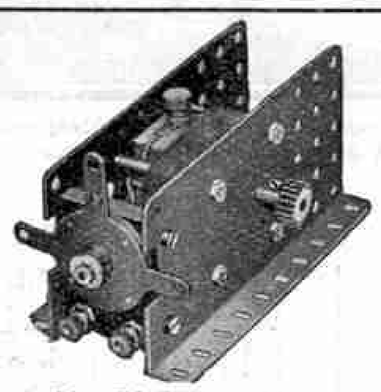
MECCANO ELECTRIC MOTOR No. E20a (20-Volt)
A powerful non-reversing motor ... Price **16/6**

MECCANO ELECTRIC MOTOR No. E20b (20-Volt)
This is similar to the E20A Motor, but has reversing motion ... ... Price **18/6**

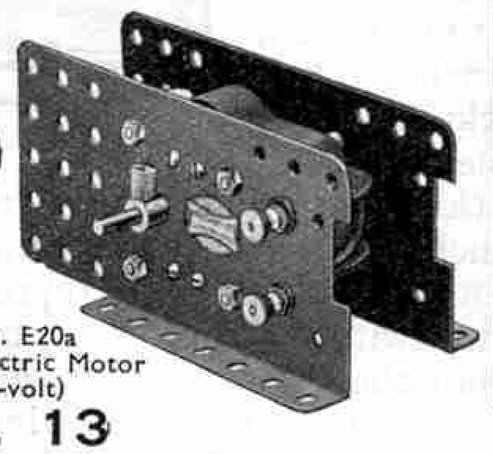
TRANSFORMERS
No. T6 Transformer (Output 25 VA at 9 volts) for 6-volt Electric Motors ... ... Price **21/–**
No. T6M Transformer (Output 25 VA at 9 volts) for 6-volt Electric Motors ... ... Price **16/6**
No. T6A Transformer (Output 40 VA at 9/3½ volts) for 6-volt Electric Motors ... ... Price **26/6**
No. T20 Transformer (Output 20 VA at 20 volts) for 20-volt Electric Motors ... ... Price **21/–**
No. T20M Transformer (Output 20 VA at 20 volts) for 20-volt Electric Motors ... ... Price **16/6**
No. T20A Transformer (Output 35 VA at 20/3½ volts) for 20-volt Electric Motors ... ... Price **26/6**

ACCUMULATOR
This 6-volt 20-amp. Meccano Accumulator will give years of service ... ... Price **28/6**


No. E1 Electric Motor


No. E6 Electric Motor


No. T20 Transformer


No. E20a Electric Motor (20-volt)

MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13

Aluminium—(*Continued from page 773*)

aluminium by a similar method to that which had yielded potassium. Davy had only voltaic cells to supply electric current, but Deville was able to use the electric arc, and in 1854 he succeeded where Davy had failed.

For many years after Deville's experiments, aluminium remained too rare and costly to be used in industry. Then came the rapid development of the dynamo, which placed an ample source of electric power at the disposal of the chemist, and to-day aluminium is produced in enormous quantities by passing electricity through melted ores of the metal. The process is continuous, the iron boxes in which it is carried out being fed with alumina, and molten aluminium separating out as easily as potassium did in Davy's pioneer experiments. The metal sinks to the bottom of the liquid, and is tapped off as readily as is iron from a blast furnace.

We have already referred to the many uses that have been found for aluminium, and the lower illustration on page 773 shows one of the most sensational applications that have been found for it. This is in welding. For this purpose the metal in the form of a very fine powder is mixed with the oxide of a metal, and the mixture is packed round the joint to be welded, and ignited by means of a strip of lighted magnesium ribbon. The aluminium seizes the oxygen of the second ingredient, and the metal of this is set free. The action travels through the mass like an explosion, the temperature becoming so high that the ends of the joint and the liberated metal are fused together.

In the example illustrated the aluminium powder is mixed with iron oxide in order to enable steel rails to be welded. Such a mixture is known as Thermit, and the ease with which it enables a very high temperature to be obtained almost anywhere has led to the description of the Thermit welding process as "a blast furnace and smithy for the waistcoat pocket."

A Cycle Lamp for Dark Nights

The amount of motor traffic now on the road is so great that pedal cyclists cannot be too careful in ensuring their safety. Surprisingly large numbers of road accidents are caused through inadequate lighting, and every cyclist, in consideration for others as well as for himself, should possess a strong headlamp for night riding. An efficient lamp for this purpose, made by Pifco Ltd., gives a 90-ft. beam, and provides 30 hours' lighting from two pocket batteries. A switch is provided that enables one or both batteries to be brought into use according to the amount of light required. This useful lamp is sold at the moderate price of 5/–.

Model-Building Results—(*Cont. from page 789*)

a top wing span composed of a Centre Section Plane and two Extension Planes. The wings are fixed to the Fuselage by eight Angled Centre Section Struts placed above and below the Fuselage. The undercarriage is of standard type and is fixed as near as possible to the nose of the machine, and the wings are spaced by two Staggered Interplane Struts placed on each side of the Fuselage and braced with cord. The tail unit is constructed on the usual lines and the engines are made with the standard Engine Casings and fitted with small Propellers.

Another model by the same competitor represents a Westland "Wessex." This makes use of a small type Fuselage, and a wing made with a Centre Section Plane and two large Main Planes, which is fixed to the Fuselage by Straight Centre Section Struts. The undercarriage is spaced from the fuselage sides by Propeller Brackets. A model of the F.E.2b, and a fine reproduction of the Sikorsky amphibian, completed this competitor's entry.

A new competition for aeroplane models is announced elsewhere in this issue.

H.R.C. Junior Section—(*Continued from page 797*)

a part of one, it is usual to display a special bill or poster on the wagons giving details of the product in question. An example is shown in one of our photographs. Here a Hornby Van has had attached to it one of the small labels, familiar to most boys, that are found on Fyffes' bananas. These may be used as ordinary posters on walls, station buildings, and elsewhere, or as suggested in the photograph. It will be noticed that the L.M.S.R. Meat Van of the Hornby Series has been made use of. The label covers the word "Meat" on the door of the Van, and as it is an insulated vehicle its use for the carriage of bananas is appropriate. Many L.M.S.R. vans for different purposes are of similar construction, and by the use of suitable labels hiding the word "Meat" the Hornby Van may be adapted for several other purposes in addition to its designed use. The L.N.E.R. Fish Van may be treated in a similar manner by covering the word "Fish" with an adhesive label bearing the name of some well-known commodity that is usually conveyed in a ventilated van. The reason we suggest adhesive labels is that they may be easily removed when the vans are again required for the conveyance of meat and fish.

Many of the smaller Posters of the Hornby Series may be used for similar schemes, in addition to those that may be adapted from the cartons to be found in every home. Any special ones that are required may be prepared with the aid of inks or paints of various colours, and will not present much difficulty.

Lubrication Means Better Cycling

Good lubrication is the keynote of an interesting little leaflet just issued by the County Chemical Company Ltd., Chemico Works, Birmingham. It tells many simple little facts concerning the importance of regular and good oiling that every cyclist ought to know. An interesting feature is the incorporation of an oiling chart to help the keen cyclist to check up the dates on which he lubricates his machine.

The County Chemical Co. Ltd. will send a copy of the leaflet free to any reader who writes mentioning the "*M.M.*"

Primitive Man—(*Continued from page 751*)

the uses of metals, thus laying the foundation of our modern civilisation. For this reason, modern Man is distinguished from the race represented by Java Man, Peking Man, Piltdown Man and Neanderthal Man by the name *Homo sapiens* which, as we have already explained, means "Wise Man." The earlier types of humanity, so astonishingly revealed to us by excavations in various parts of the world, were primitive and uncouth relatives of the ancestors of *Homo sapiens*, but they are of perpetual interest because they show the stages through which the human race has passed to reach its present dominating position.

It is interesting to speculate on the original home of the men of our own race. As we have already remarked, *Homo sapiens* is believed to have entered Europe from Northern Africa, and relics of early human beings of this type have been discovered in East Africa. It is claimed that these are the remains of the oldest true human beings of the modern type, but it is possible that this distinction belongs to a skull that was discovered nearly eight years ago in the heart of the city of London. It was recovered from a depth of 42 ft. during excavations in preparation for building a new home for the Corporation of Lloyd's in Leadenhall St., where there once stood East India House, the headquarters of the Company that laid the foundations of our Indian Empire. The skull is that of a woman who was probably 50 years of age, and the peculiar formation of the brain cast obtained from it suggests that she was left-handed.

Although it appears probable that the London skull is a relic of the most ancient of human beings of modern type, it does not follow that this country was the original home of *Homo sapiens*. It is far more likely that our race began in East Africa, and further discoveries in that part of the world will be eagerly looked for in the hope that they will throw light on this interesting problem.

We are indebted to Professor G. Elliott Smith, D.S.C F.R.S., for valuable assistance in the preparation of this article, and also to the editor of the "Scientific American," who kindly lent photographs for use as illustrations.



Branch Notes

SHEFFIELD.—The Certificate of Incorporation was received with enthusiasm, and quickly framed and hung up in the Branch room. The track has been re-laid on a new plan, and timetables have been carefully worked out and typewritten for distribution among members taking part in operations. A proportion of meetings has been devoted to cricket and other outdoor games, and the L.N.E.R. Goods Yard and Locomotive Sheds have been visited. Secretary: W. B. Hutchinson, 35, Linden Avenue, Sheffield 8.

SUTTON AND DISTRICT.—Members continue to make progress in operations on the Branch track, on which the Hornby Control System is now being installed. A new Branch room is urgently required in order to enable more satisfactory track to be laid down. A Lantern Lecture on *"Britain's Largest Railway"* has been given, the slides being kindly loaned by the L.M.S.R. Secretary: D. Wakely, Hillbury, Holland Avenue, Cheam, Surrey.

WOODFORD.—A record attendance was an encouraging feature of the July meetings, which were devoted to track operations and indoor and outdoor games. Clock golf is one of the games enjoyed by members and frequent programmes are arranged. The track has been re-laid and all railway material carefully overhauled in preparation for the meetings of the first winter session. Secretary: J. H. Skelt, 27, Woodside Road, Woodford Wells, Essex.

WIMBORNE GRAMMAR SCHOOL.—The Branch took part in the School Handicraft and Hobbies Exhibition, an efficient layout that included passenger stations and goods yards being operated to timetable. The display attracted the admiration of hundreds of visitors and was favourably noted in press reports. The Branch room has now been re-decorated, and members are at work improving the passenger and goods stations on the Branch layout and constructing tunnels and cuttings. "Binns Road" station has been greatly extended, and double track laid from there to "Hornby South." The distance between the termini of the Branch layout is 86 ft. and the length of track in regular use is 260 ft. Secretary: J. K. Bennett, 120, Newington Causeway, London, S.E.1.

ST. SAVIOUR'S (RAYNES PARK).—Strict timetable working has been introduced at track meetings. A preliminary talk was given on the duties of every official concerned, and a large map of the track drawn in order to facilitate working. After trials of various methods of time-keeping, two large clocks were so placed that every member could see one of them readily. On Games Night an all-round competition was arranged, the winner of a series of games at billiards, table tennis and darts, being awarded a large tin of sweets. Secretary: D. J. Fielden, 117, Bushey Road, Raynes Park, London, S.W.20.



A group of members of the Streatham Common Branch. Chairman, Mr. C. H. Stephens; secretary, L. J. Ling. Our photograph was taken during their recent Exhibition, at which regular trips were made on the splendid 5 in. gauge railway shown above. The locomotive is a scale model of the L.S.W.R. "Adams" 4-4-0 locomotive, No. 592, and was kindly loaned by Mr. R. Gosnell for use at the Exhibition.

MAIDSTONE.—During the summer cycle runs to places of railway interest have been arranged and interesting photographs taken. Photographic results this year were better than in previous sessions, largely because of the introduction of new cameras and the use of faster films; and an excellent library of railway photographs has now been collected. Secretary: W. Hills, "The Orchard," Lord Romneys Hill, Maidstone.

AUSTRALIA

KEW.—Work on the Branch track continues steadily. The main line is electric, but a branch line from the central station is operated by means of clockwork locomotives. Visits have been paid to the North Melbourne Locomotive Sheds and the liner *"Mariposa."* A scheme for arranging Visits and Exhibitions in conjunction with local Meccano Clubs and H.R.C. Branches is being considered. Secretary: A. J. McCutcheon, 20, Studley Avenue, Kew, E.4, Victoria.

PARRAMATTA.—The Branch track is being slowly but steadily extended and provides splendid running practice. It consists of single track and is operated on the staff system, instruments for this purpose being fitted in the signal boxes. Great care is taken of rolling stock, which is thoroughly cleaned before being put away after each meeting. A branch line, to be operated by means of a small tank locomotive and bogie car, is being added to the layout. Secretary: H. H. Matthews, 27, Ross Street, Parramatta, N.S.W., Australia.

SYDNEY.—The Autumn Exhibition, held in conjunction with the Sydney M.C., attracted 450 visitors, and the proceeds amounted to £10 10s. 6d. Goods and passenger trains were run to timetable on the Branch layout. The electric signals were in operation, and all coaches were electrically lighted by means of third rail connections. The service was perfect, not a single derailment or accident marring operations. A special competition was arranged in connection with the Exhibition for the best home-made model for use on the Branch track. Bunnerong Power House was visited by members of the Branch, who were accompanied by members of the Cremorne M.C. Secretary: W. J. T. Watson, 595, Parramatta Road, West Leichhardt, N.S.W., Australia.

Proposed Branches

The following new Branches of the Hornby Railway Company are now being formed, and boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

HOLLAND—H. J. Borgman, M. Wijnandstr. 12, Maastricht.

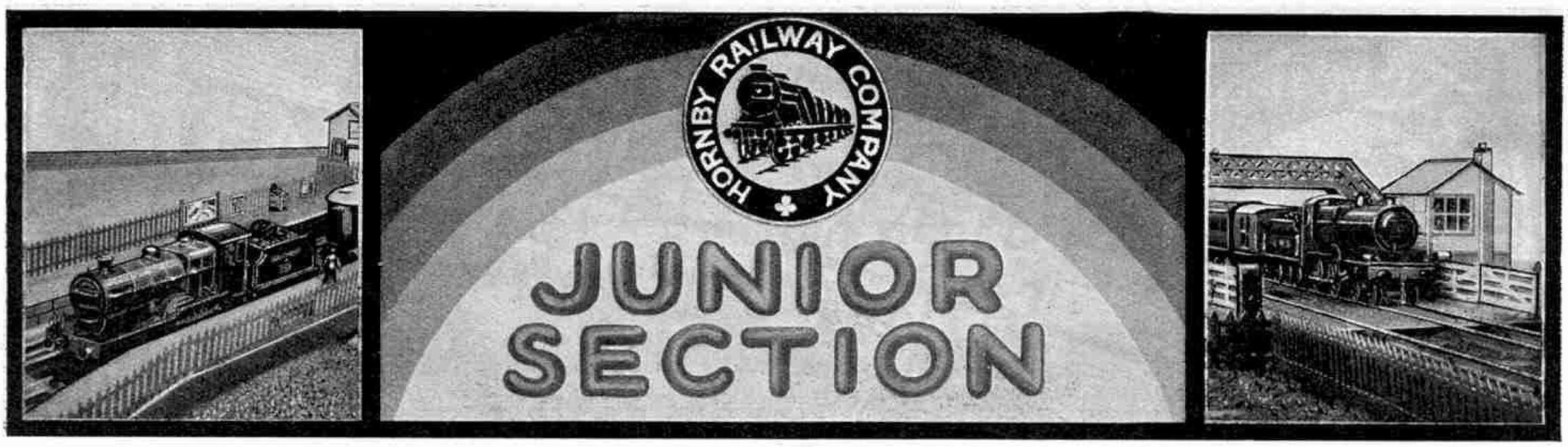
LEICESTER—M. Simpson, 86, St. Michaels Avenue.

LONDON—A. C. Chantrain, 10, Hilda Road, Brixton, S.W.9.

NORTHWOOD—Geoffrey Dobson, 3, Grove Road, Northwood.

SITTINGBOURNE—E. H. Hubbard, "Blenheim," London Road.

SOUTHSEA—K. MacDonald, 126, Kingsley Road.



LVIII.—HOW TO ADD "LIFE" TO LAYOUTS

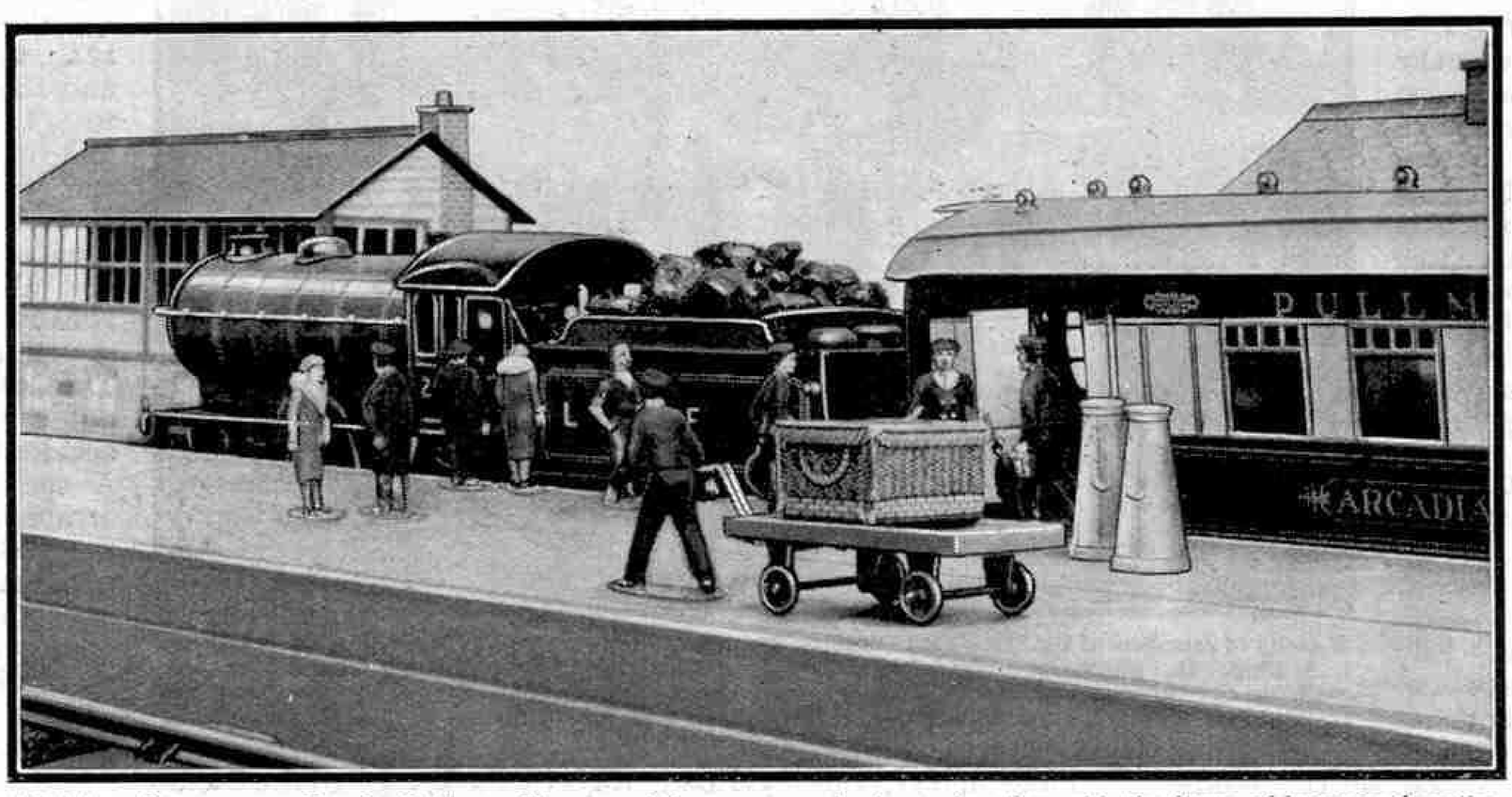
ONE of the commonest faults to be observed on miniature railways is the absence of "life" about the system generally. However elaborate the layout may be, and however smart the operator, the railway will fail to give the impression that it represents a busy real system unless good use is made of the numerous miniature figures that are now available. Efficient train services and abundant accessories will not prevent a line from having a "dead" aspect if no activity on the part of the railway staff is apparent, together with some evidence of people and animals in the neighbourhood of the lineside and at stations or goods yards.

The life-like attitudes of the various figures in the Hornby Series immediately transform the scene. First of all there is the Railway Staff of Modelled Miniatures No. 1; they should be the first to be provided, for the service of the line cannot possibly be carried on without them. Then of course it is necessary to provide Passengers, Modelled Miniatures No. 3, to show that the railway company have some reason for the operation of their train service. The numbers of passengers at the various stations on the layout will depend upon their relative importance. Whereas two or three figures would be sufficient on a country branch halting place, suitable "crowds" should be arranged at terminal and junction stations, especially if "rush period" traffic is being dealt with.

Although "luggage in advance" is now such a popular feature, large numbers of travellers, especially those for long-distance trains, still have a considerable quantity of baggage that must be attended to. Some enthusiasts actually despatch miniature luggage by passenger train in the proper manner, and certainly when this is done the entertainment of train operation is considerably increased. This matter of luggage reminds us of the contents of the very useful and popular set of Railway Accessories No. 1. The various trunks, bags and hampers may be arranged on the barrow provided in the set, or when a large quantity has to be dealt with, the four-wheeled trolley as used for the milk cans may be pressed into use. The milk cans and their trolley are included in Railway Accessories Set No. 2, and are still necessary on station platforms, in spite of the use of Milk Tank Wagons.

In addition to the members of the railway staff of the traffic and locomotive departments there are the smart waiters and car attendant of Modelled Miniatures Set No. 5. They should be in evidence on the platform before the departure of a dining or sleeping train, arranged in the manner suggested last month. They may actually travel on the trains if desired, a blob of Seccotine on their bases being sufficient to keep them in their places in Pullman and Saloon Coaches. They will not be generally in evidence, but will look realistic as we catch a glimpse of them through the windows of the vestibule doors or passing down the coach. At the larger stations, too, the Hotel Porters of this Set may be appropriately used. The Engineering Staff of Modelled Miniatures Set No. 4 may also be employed to some extent on miniature railways, engine sheds, signal cabins, and in and about stations being likely places for them.

The useful Farmyard Animals of Modelled Miniatures Set No. 2 must not be overlooked. Besides their obvious uses in the lineside fields provided by the Countryside Sections, they can be arranged in pens in the goods yard, as if waiting to be loaded into the appropriate Cattle Trucks. Here again some enthusiasts actually load up their vans with miniature animals and transport them from place to place in a realistic manner. Heavy traffic of this kind may be supposed to be due to agricultural shows, market days and livestock sales,

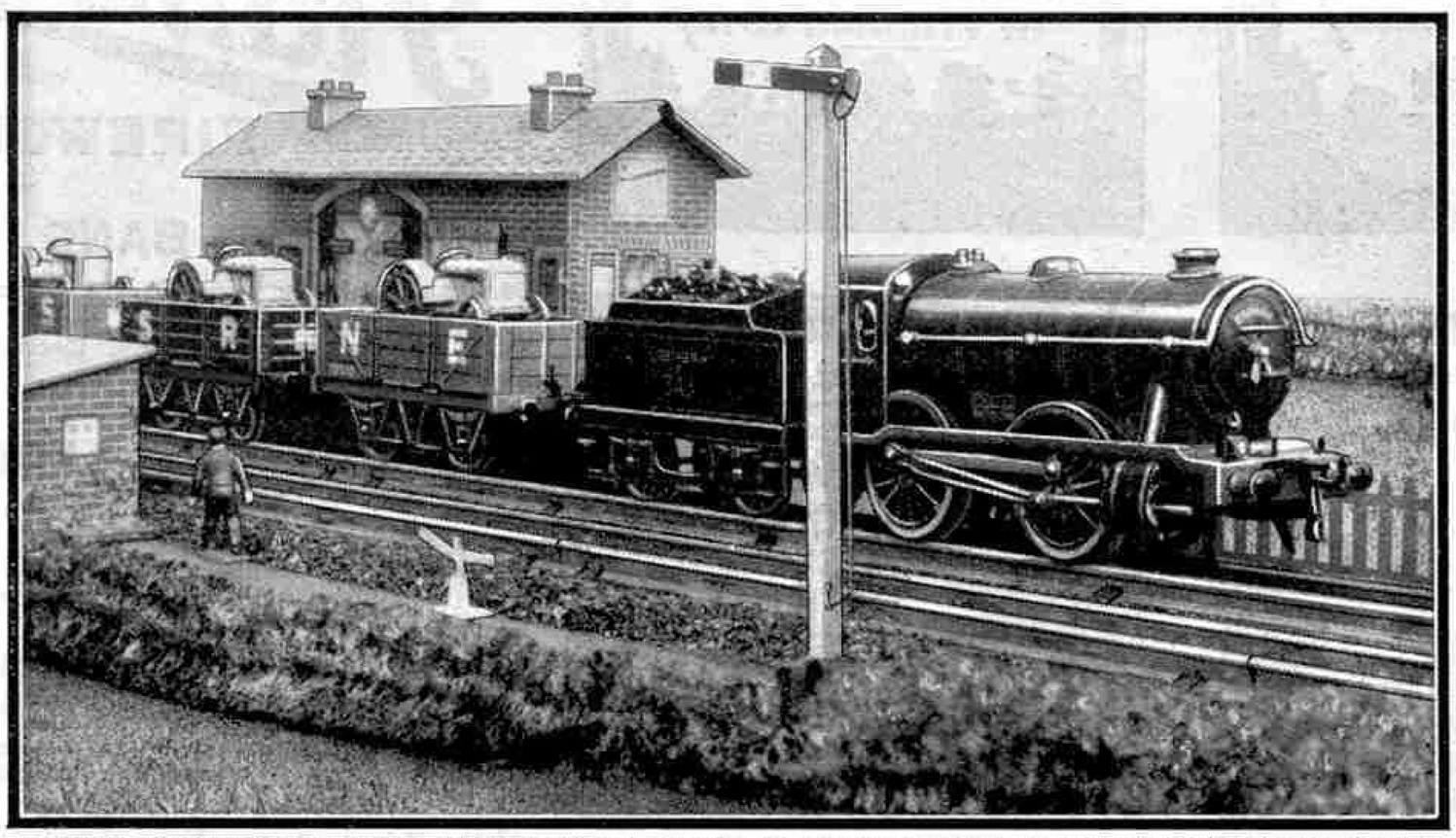


Miniature figures on a Hornby Station. The use of these accessories in conjunction with the items of luggage gives the scene an exceedingly life-like appearance.

which should be duly advertised on the stations concerned, and will provide opportunities for special passenger train running in connection with them. A suitable pen may be formed from a length of standard Passenger Platform and one Ramp duly provided with Paled Fencing. A more elaborate accessory of this kind may be made up as suggested in the August, 1932, "*M.M.*" by those who desire to make a feature of livestock traffic.

Yet another set of Modelled Miniatures is now available, No. 22. The miniature Motor Vehicles included in this set are very suitable for use in conjunction with Hornby railways, not only on the roads near the line and by level crossings, but also as loads that may be conveyed from point to point by goods or passenger train as appropriate. For the transport of the motor cars the most suitable vehicle in the Hornby Series is the No. 2 Luggage Van. The variety of uses to which this can be put makes it similar to the "general utility" bogie vans of the Southern Railway, while some equally adaptable vehicles have recently been put into service by the L.M.S.R. Two cars may be loaded into the Hornby Van, the wide doors making this process quite an easy one. A cardboard "ramp" may be used to enable the vehicles to be run off the loading platform into the Van, and when they are inside they may be kept from moving about by "wheel bars" formed of strips of cardboard or thin wood jammed across the floor between the sides of the Van.

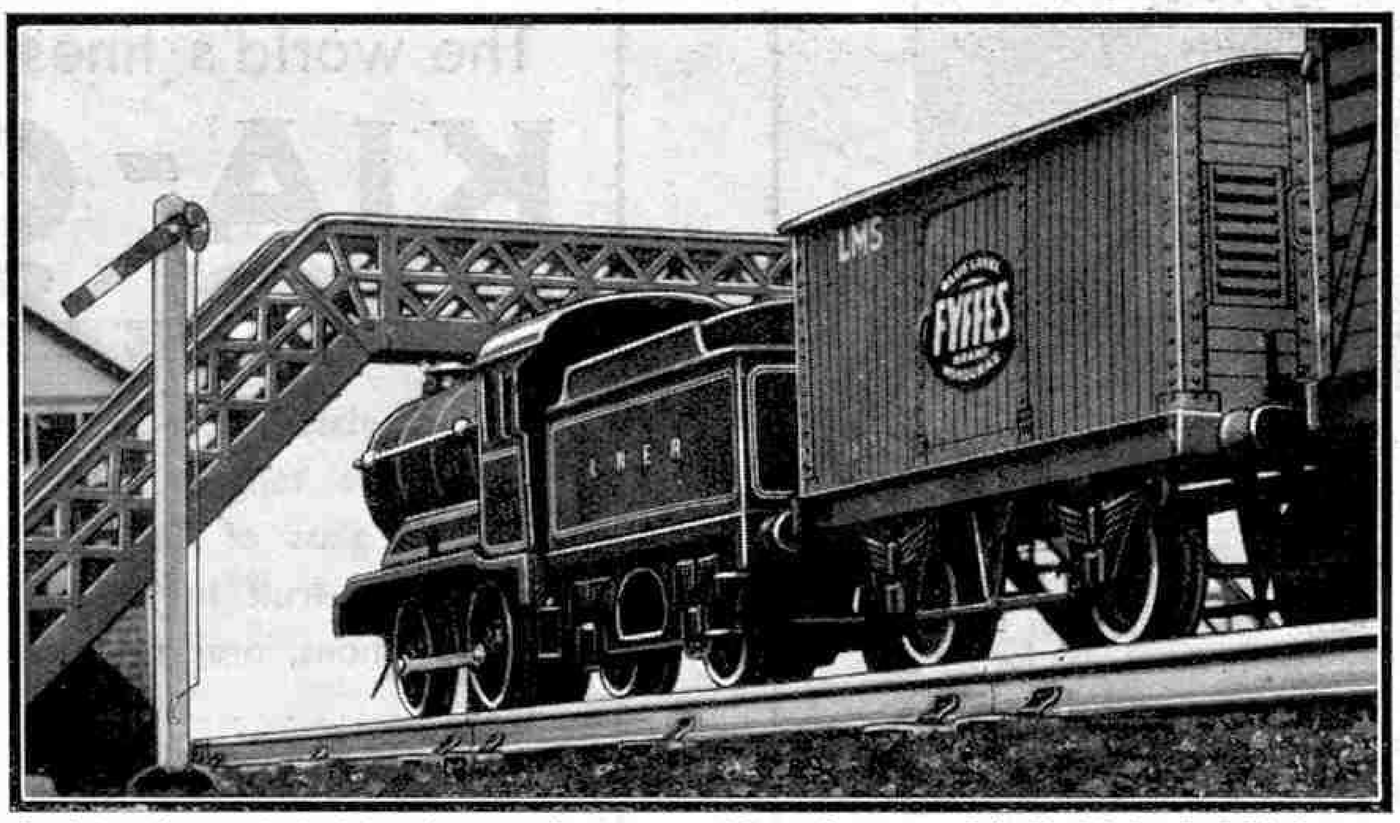
The commercial vehicles, both open and covered, are very suitable for railway road delivery service, and may be painted and lettered in the colours and style of the various companies by those who are keen on completeness of detail. Several of them about the roads and goods premises of a miniature system will look very realistic. When required to be carried by rail they may be loaded suitably on the flat Timber Wagon. Single vehicles may be conveyed on the No. 1 Timber Wagon, and their length is such that "wheel bars" of cardboard or wood, as before, may be placed across the wagon between the upright standards provided, for keeping the load in place. Lorries or vans thus loaded may be covered with a wagon Tarpaulin if desired, though they look more attractive without this. If complete consignments are being dealt with, possibly for shipment abroad, as many as three of these vehicles may be loaded on to a bogie No. 2 Timber Wagon.



A through goods train carrying a load of tractors. These, and other vehicles, of Modelled Miniatures No. 22, may be usefully employed on Hornby layouts.

The miniature tractors are particularly suitable for loading purposes, and one of our illustrations shows a train of these carried in open wagons. If preferred they might be conveyed on timber wagons, as in the case of the vehicles previously mentioned.

The army tank is a very spectacular vehicle. Its presence near to or actually on the railway may be due to military manœuvres, so that good use may be made of the miniature soldiers that are generally available. Tanks may be transported by means of the Trolley Wagon, the well of which accommodates a single tank comfortably. In this case loading from the ground level is possible, owing to the low well of the wagon and the climbing ability of the real tanks. Where several tanks are to be carried, they can be loaded off a platform over the end of Timber Wagon No. 2. They are just narrow enough to pass endways down the truck between the standards.



An interesting method of drawing attention to a special consignment. Suitable labels of all kinds may be used by Hornby railway owners for this purpose.

While most of these vehicles will be conveyed by goods train, there is no reason why a No. 2 Luggage Van, loaded with motor cars, should not be attached to a passenger train. This is frequently done in these days, as special facilities are available when their owners are also making the journey. Another possibility is the transport of a number of these cars for a miniature motor show. In this case they will probably be conveyed in a special train made up of No. 2 Luggage Vans. These trains are a feature of actual practice in connection with the well-known motor shows at different centres.

This special train running reminds us of an interesting practice often carried out nowadays. Where a consignment of any particular article is being conveyed, either in a complete train or merely as (*Continued on page 794*)









ASK AT THE SHOP FOR THESE

"Standard" FIREWORKS

THESE ALL BANG

½d. each. Fizbangs, Little Demon Cannons, Flash Bombs, Thunderbolts, Crashers.

1d. each. Big Demon Cannons, Electric Guns.

2d. each. Shrapnel Guns, Air Bombs, Sky Scrapers.

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½d. each. Flyers Catherine Wheels, Flying Imps, Golden Fountains, Silver Trees.

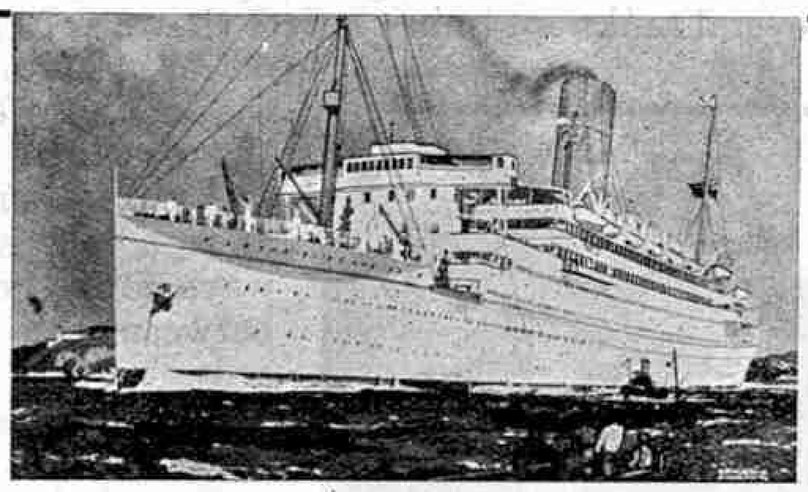
1d. each. Fairy Fountains, Golden Orions, Snow Storms, Fire Tops, Silver Fountains, Hoppity Hops, Robots, Pyramids of Jewels, Star Shells, Rotalex Whirlers, Giant Sparklers.

2d. each. Egyptian Pyramids, Colour-Wheels, Golden Zodiacs, Lighthouses, Robots, Guy Fawkes Barrels, Volcanoes, Shooting Star Fountains, Whirling Suns.

And all the old favourites : Rockets, Jumping Crackers, Roman Candles, Jack-in-the-Boxes, etc., etc.

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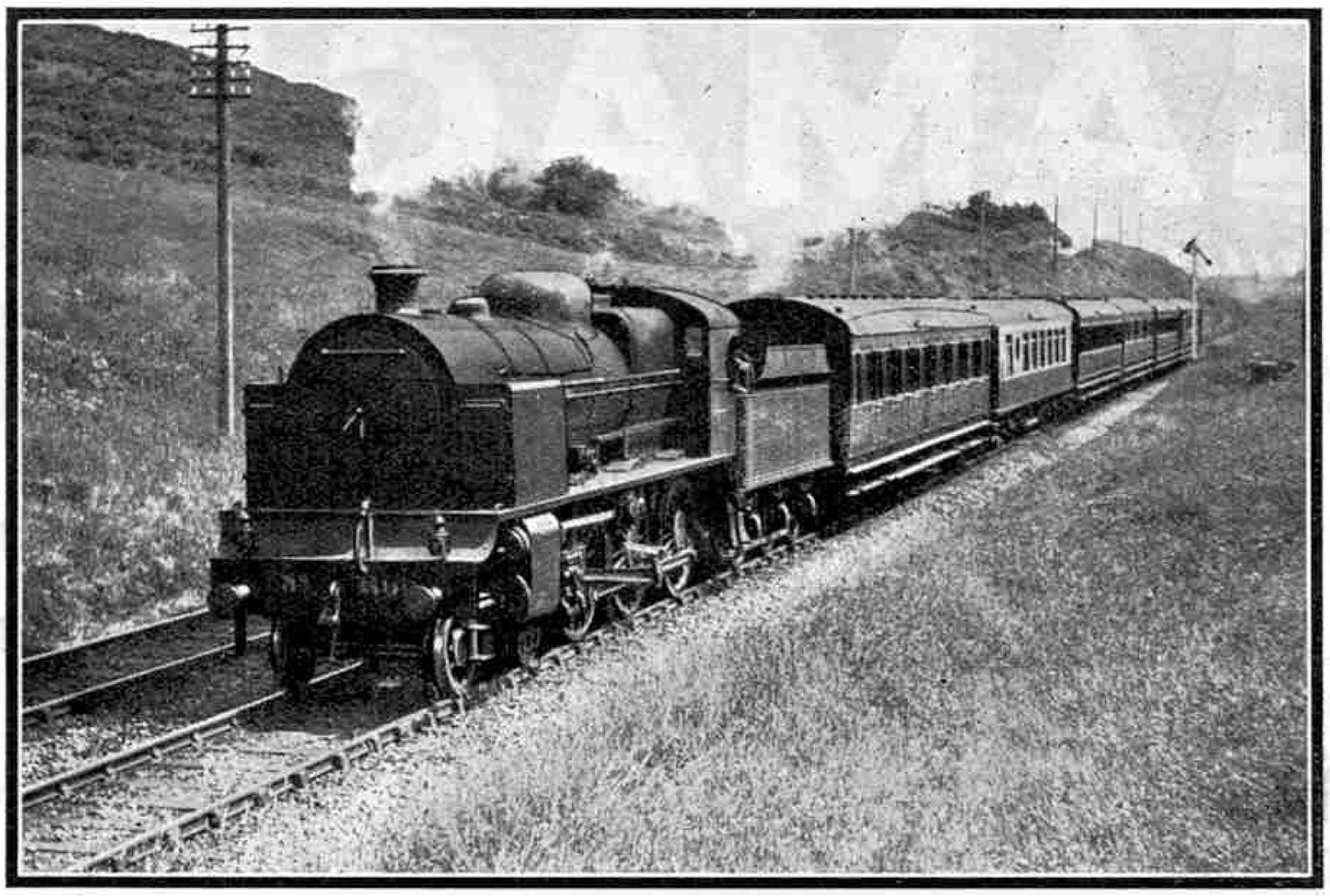
H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Liverpool 13. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

"IMPOSSIBLE TRAIN CONTEST" No. 4

A policy of co-operation between the different railway groups has been a marked feature of recent times, with the result that in many cases it is possible to go from one place to another by one route and to return by what is perhaps a competing line. Some very interesting journeys may be made in this way, but none, we venture to think, will provide so much excitement or variation as the trip described on this page! We are presenting this as the subject of our competition this month as another example of an "*Impossible Train Contest*," in which the various mistakes have to be pointed out and listed by competitors. Here is the story:—

"The journey was made on one of the fastest trains of the day, the famous "*Thanet Pullman Limited*" of the L.N.W.R., on a fine calm Saturday in September. An articulated set of five vehicles made up the train, and we noticed several boiler trolleys attached in the rear. These, it appeared, were to be slipped at Symington, the junction for Oxford and Cambridge. The engine was one of the familiar three-cylinder compound "Lord Nelsons," with smoke deflectors, as can be seen in the accompanying photograph taken during the journey.



The famous "Northern Belle" approaching Peterborough on the run described on this page. The locomotive at its head is one of the well-known G.W.R. "Pacifics."

"Evidently a very capable driver was in the motorman's compartment, for we passed Woking two miles out in 15 minutes, after a brisk climb up the bank from King's Cross. A stop of five minutes sufficed for the attachment in our rear of the Torquay portion that had left Aberdeen earlier in the day. We ran easily through the suburban area owing to the possibility of signal checks, though actually none occurred, but once on the open main line stretches we went like the wind. The "*Cheltenham Flyer*" was overhauled in fine style near Newcastle, although the 2–8–0 at its head was putting forth its best efforts. Between mile-posts 47 and 50, where the overtaking occurred, we averaged 64 m.p.h., the two miles taking five minutes exactly.

"This excitement over, we forged ahead to Preston, where the 2–8–0 : 0–8–2 L.N.E.R. Beyer-Garratt locomotive was waiting to be attached in order to help us over the steep gradients of the Waverley route. Passing over the water troughs at Stanley Junction we reached Stoke-on-Trent, where we found that another engine was to take us forward. This was No. 2547, "*The White Knight*," of the "King Arthur" class.

"We negotiated the lonely single-line section between Sheffield and Nottingham where, as on other parts of the G.W.R. main line, automatic train control apparatus is installed. Threading Glenfarg and Martello Tunnels we ran smartly into Queen Street Station, Plymouth, and in spite of delays it was observed that we were some minutes early at the conclusion of our non-stop run."

We do not think readers will have much difficulty in detecting errors, and these should be listed on one side of a sheet of paper in the order in which they occur. The competitor's name, membership number and full address should be written on the reverse side of the sheet, and the entry enclosed in an envelope marked "*H.R.C. Impossible Train Contest No. 4.*" Entries should be posted to reach Meccano Ltd., Binns Road, Liverpool 13, not later than 31st October. The closing date for the Overseas entries is 31st January, 1934.

To the senders, in both Home and Overseas Sections, of the four most complete lists of mistakes, prizes of Hornby railway material (or Meccano products) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded. In addition there will be a number of consolation prizes for entries that are of outstanding merit, but fail to reach prize-winning standard.

Questions Contest No. 5

This month we announce a "Questions Contest" on the lines of those that have proved so popular on many previous occasions. There are twelve questions, and competitors are required to answer as many of them as they can. The answers should be given in as few words as possible. Competitors who find themselves unable to answer all the questions should nevertheless send in their entries.

(1) How is it possible to ascertain the direction of traffic, apart from observing the signals, where there are two fast lines and two slow lines adjacent to one another? (2) What happens when the communication cord in a compartment is pulled, and how does the guard identify the compartment from which the alarm signal was sent? (3) Sometimes a two-cylinder locomotive will not start when the regulator is opened. How is this? (4) What are catch points, and under what conditions are they installed? (5) On some railways, when an assistant engine is necessary on a train, it is attached behind the train engine, not in front. Why is this? (6) What is meant by the phrase "Rule 55 Exempt"? (7) How does a signalman at a junction know which way he has to send a train? (8) How would an engine driver stop a train if the regulator jammed in the open position? (9) At night, how does the driver of a goods train know that his train is complete? (10) How does a fireman stop a locomotive from blowing off? (11) When a number of tracks pass under a gantry, how can the signal for the fast line be distinguished? (12) What do two yellow lights indicate on a four-aspect colour-light signal?

To the senders of the four best sets of answers received will be awarded Hornby Railway material (or Meccano products) to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition there will be a number of consolation prizes. Each competitor should endeavour to write his answers on one sheet of paper only, on the reverse side of which must appear his H.R.C. membership number, name and full address. Envelopes must be marked "*H.R.C. Questions Contest No. 5*," and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st October. A separate set of prizes will be reserved for Overseas competitors, whose entries must arrive not later than 31st January, 1934.

COMPETITION RESULTS

HOME

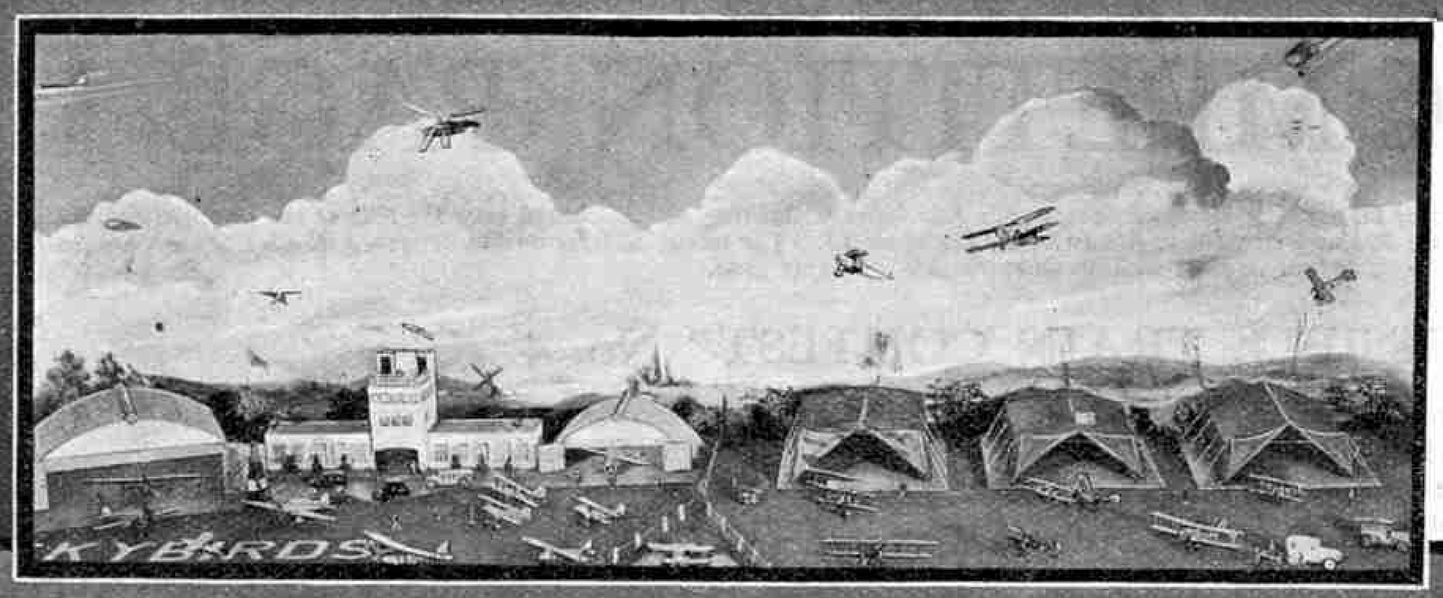
July "Famous Trains Contest."—First: W. W. Boyles (17260), Sheringham. Second: R. C. T. Lyle (30157), Hereford. Third: J. Mathewson (34686), Glasgow. Fourth: C. E. Wrayford (6039), Moretonhampstead. Consolation Prizes: H. S. G. Darke (4461), Hampstead, N.W.6; J. T. Trotter (11447), West Dulwich, S.E.21; S. A. Molesworth (3894), East Budleigh, Devon; G. R. Palmer (6610), Leicester; J. Cables (21250), London, S.E.13.

July "Railway Photo Contest."—First: S. Garbutt (30122), Altrincham, Ches. Second: F. G. H. Kennedy (25074), Bolton. Third: J. W. Hague (1258), Ripon. Fourth: G. M. Lane (11170), Wakefield.

July "Railway Drawing Contest."—First: V. C. Kaile (17559), Mayford, Nr. Woking. Second: R. C. Storrar (8625), Letham Ladybank, Fifeshire. Third: L. Martin (6922), Leicester. Fourth: F. H. Jones (34409), New Barnet, Herts. Consolation Prizes: A. D. Gosman (4201), Beckenham, Kent; G. T. Porter (10259), New Barnet, Herts.

OVERSEAS

April "Railway Photo Contest."—First: J. A. Coates (23863), Quebec, Canada. Second: R. B. McMillan (9592), Melbourne, Australia. Third: F. D. Aria (12362), Tardeo, Bombay India. Fourth: M. De Lima (34925), Bombay, India.



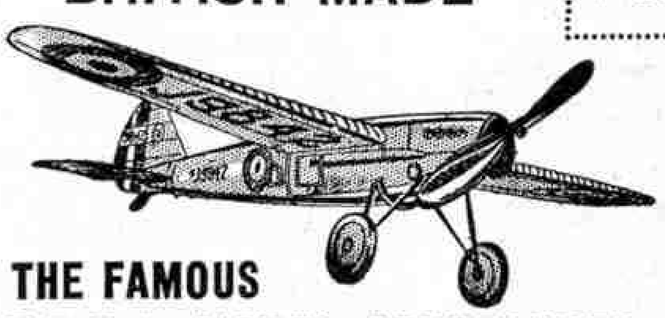
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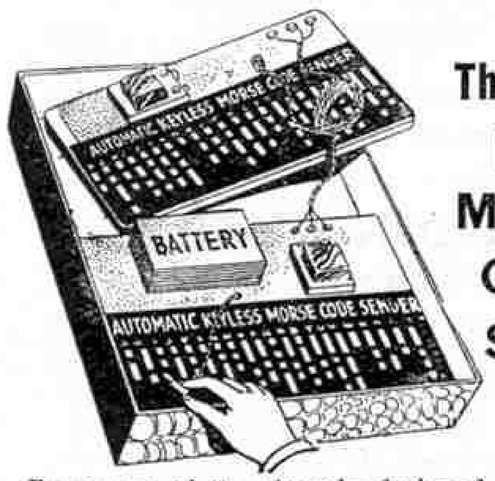
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Illustrated is a "Frog" exact to scale model of the interceptor Fighting Mark IV with R.A.F. markings which are in actual colour. Will fly 300 ft. at a height of 70 ft. Rises straight off the ground. Also obtainable in the following national colours: Argentina, Belgium, France, Italy, Holland and U.S.A. Complete in patented container box. Price each **7'6** Post 6d.



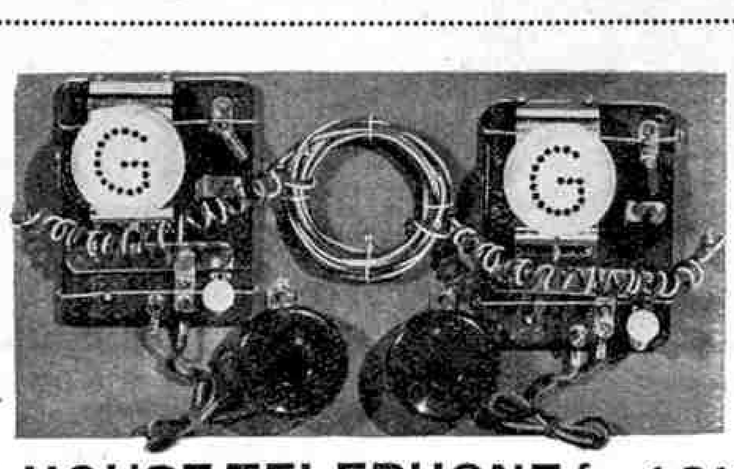
The Latest Idea in MORSE CODE SETS

By means of the cleverly designed alphabetical board in these sets, boys with only the slightest knowledge of the morse code can send or receive messages. All that is required is an ordinary pocket battery. Price complete with battery. **10'6** Post free.

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Gamages specialise in Hornby Part Exchange Scheme for Locomotives. Write and ask us how you can obtain a new Locomotive for an old one—we will post you a leaflet with full particulars by return.

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A HOUSE TELEPHONE for 12'6

No construction necessary. Merely insert an ordinary pocket battery and the telephone is ready for operation. Audition is perfect over long distances. It is not even necessary to speak close to the mouth piece as the Carbon Granule Transmitter acts as a microphone. Price **12'6** Post 9d.
15-ft. Coil triple bell wire supplied with the set. Extra lengths: 30 ft., **1/6**; 60 ft., **3/-**.

WORKING MODEL TELEPHONE



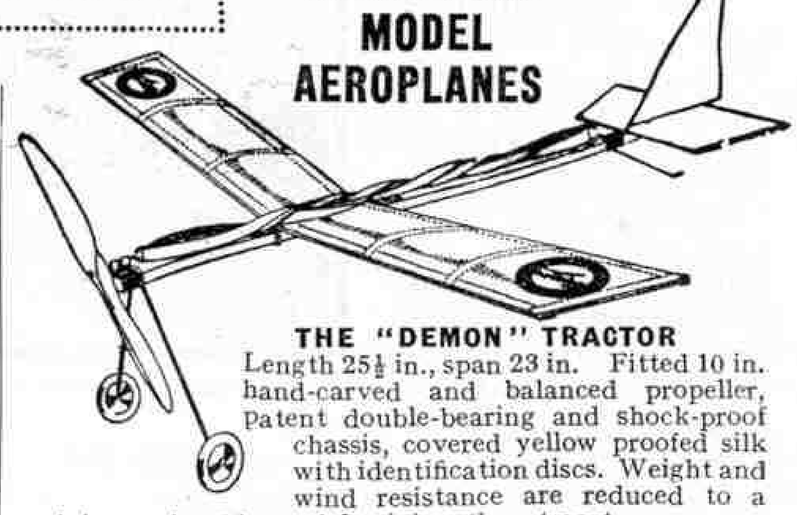
A replica of the latest type of Post Office Public Telephone. It consists of a polished Bakelite Pedestal and Telephone, and the Signalling Buzzer is housed inside the pedestal. Calling is entirely automatic; immediately the instrument is removed from its base the signal is given by the distant set. Although an ordinary pocket battery is used this wonderful set will give telephone communication up to one mile. Battery 4½d. extra. Price 35-ft. Flex is supplied. Extra Flex—50 ft. **4/-**. 100 ft. **7/6**. **25'6** Post 1/-

HOT-AIR BOATS ONLY 1/- EACH



These boats will travel in the water at a good speed, with loud exhaust of motor for about 15 minutes with one filling of fuel. The motor runs with a realistic Toc Toc! Solid fuel is used. Absolutely safe for the youngest boy. Full directions enclosed. Usually 2/11. Gamages Price, complete with fuel, **1/-**. Marvellous value. Extra packets of fuel **6d.** each. Post 6d.

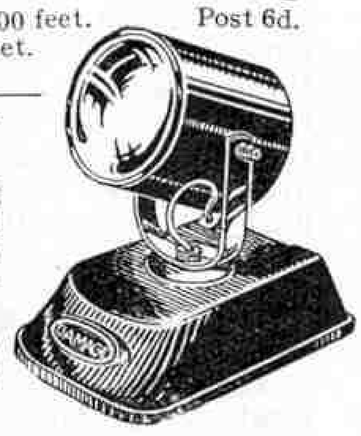
WARNEFORD MODEL AEROPLANES



THE "DEMON" TRACTOR

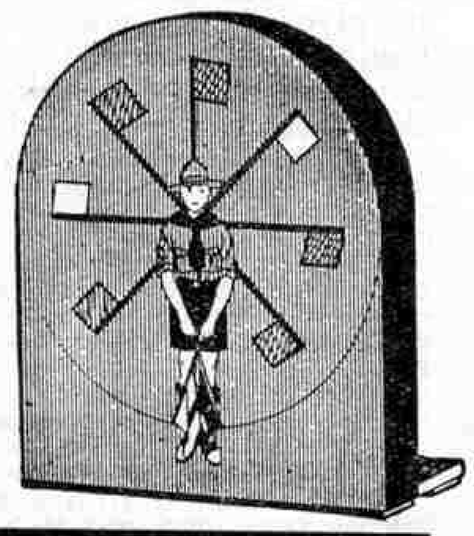
Length 25½ in., span 23 in. Fitted 10 in. hand-carved and balanced propeller, Patent double-bearing and shock-proof chassis, covered yellow proofed silk with identification discs. Weight and wind resistance are reduced to a minimum in this model, giving the utmost duration of flight. Price **7'6** Post 6d.
(Patent No. 296946.)
Weight, 3¼ ounces. Distance, 900 feet. Speed, 16 m.p.h. Ceiling, 80 feet. Rises from the ground.

MODEL SEARCHLIGHT

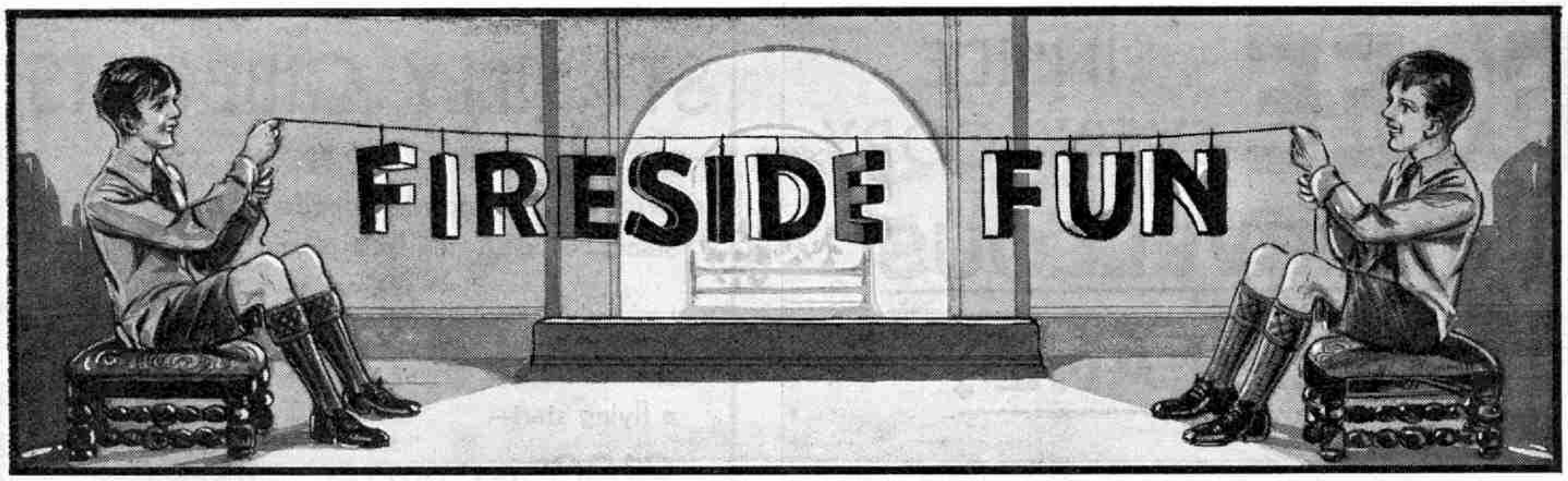


Will throw a beam of light 40 ft. in the air. Strongly made and finished in black. Replaceable battery fits in base. Dimensions: Height to top of light, 4½ in. Size of base, 4 in. × 3 in. Diameter of lens, 2 in. Price complete with battery **3'9** Post 6d.

ELECTRIC MODEL SEMAPHORE SIGNALLER



It consists of a frame with the figure of a Scout printed upon it. At the back is a board bearing a number of metal studs, each of which represents a letter or symbol in the semaphore code. The operator simply touches with a terminal the stud required which is indicated by a printed letter, and the correct flags are illuminated. An ordinary pocket battery is used. Price Battery 4½d. extra. **7'6** Post 6d.



A CUTTING REPLY

Brown: "I've been swindled! I answered an advertisement that said: 'Send two shillings for ingenious instrument that will halve all your household bills.'"

White: "What did they send you?"

Brown: "A pair of scissors."

* * * *

Mistress (to maid): "What do you mean by putting a benzine bottle on the stove? There might have been a dreadful accident."

Maid: "Bless me, how funny! It's a good thing all folks ain't as superstitious as you!"

* * * *

"I left the farm when I was 23, and came to the city; and for 30 years I have been working night and day."

"What have you been working for?"

"To get money enough to live in the country."

* * * *

Busy Man: "I really cannot see you."

Visitor: "Good! I'm selling spectacles."

* * * *

"Can you imagine anyone going to bed with his shoes on?"

"Yes, my horse does."

* * * *

Schoolmaster: "Tell me a few of the most important things existing to-day which were not in existence 100 years ago."

Pupils (in chorus): "Us."

* * * *

The shopper was on the way out after leaving her list of groceries to be delivered. Suddenly she turned and said coldly "Never mind the apples; I see the cat is sleeping on them."

"Oh, that's all right," said the shopkeeper. "She won't mind me waking her up."

* * * *

Old Lady (to policeman): "I've lost my canary. Will you please notify the Flying Squad at once."

* * * *

"Would you like some bread and butter, Eric?"

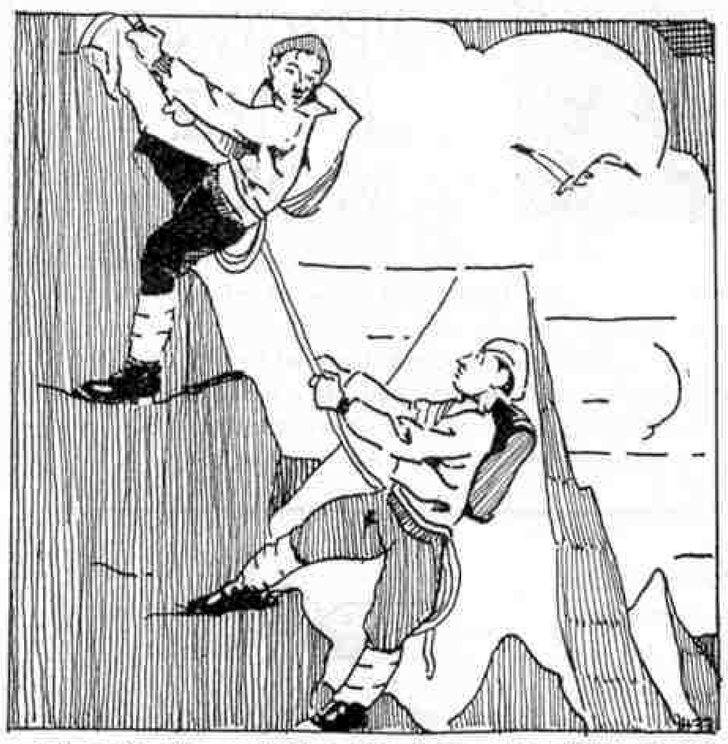
"No."

"No, what?"

"You shouldn't say 'what,' mother, you should say 'I beg your pardon.'"

* * * *

SAFE EITHER WAY



First Climber: "If I fall, keep tight hold of the rope; but if you slip, don't forget to let go immediately."

* * * *

Old Gentleman: "My little man, you mustn't say, 'I ain't goin'.' You must say, 'I am not going,' 'He is not going,' 'We are not going,' 'They are not going.'"

Boy: "Ain't nobody not goin'?"

PARTIAL SUCCESS

Mother (angrily): "Why don't you try to be a good boy?"

Johnny: "But, mummie, I do try."

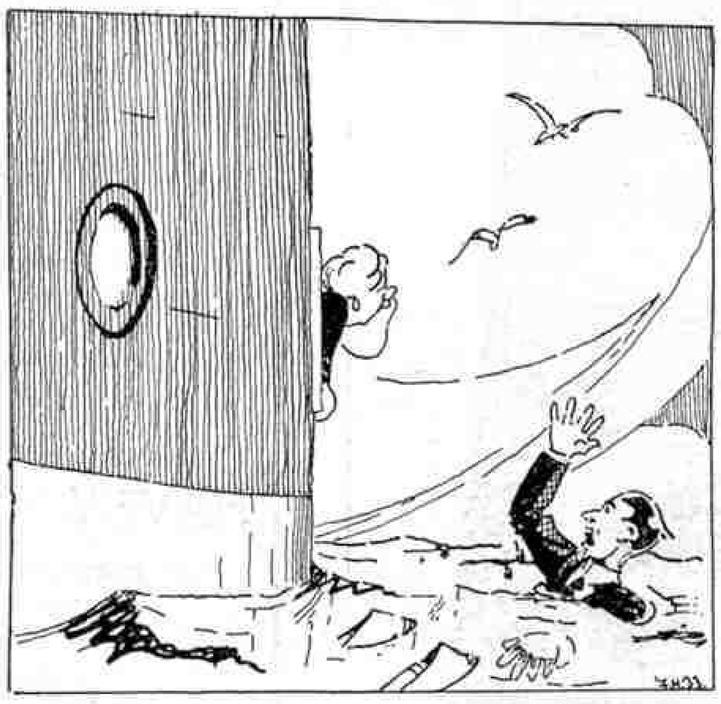
Mother: "You don't seem to succeed, though."

Johnny: "But think what a naughty little boy I should be if I didn't try at all, mummie."

* * * *

The vicar was appealing to members of his congregation to supply the refreshments for a church social.

"And now, please, remember," he ended his address, "what we want is not abstract promises, but concrete cakes."



Man Overboard: "Drop me a line someone."
Kind Old Lady: "Certainly. And you'll write to me sometimes, won't you?"

* * * *

Absent-minded Man (to shop assistant): "I want just a cheap umbrella, please, for leaving-in-the-tramcar purposes."

* * * *

"What are you doing now, John?"

"I've got a job as an apprentice with a firm of engineers, and they make calculations to thousandths of an inch."

"How many thousandths are there to the inch?"

"Hanged if I know. There must be millions."

* * * *

Customer: "Will this umbrella leak in a storm?"

Assistant: "That umbrella leak? Why madam, it's made to stand a hydrostatic pressure of 17 centimetres."

Customer: "I don't need one so good. I never go out in weather like that."

* * * *

"Johnny, didn't I tell you to count fifty when you get angry with your brother?"

"I am counting. I'm sitting on him to make sure he's here when I've finished."

* * * *

Instructor (after lecture on the principle of the parachute): "And if it doesn't open—well, that is what is known as 'jumping to a conclusion.'"

* * * *

Smith was proudly exhibiting the sole result of his day's fishing.

Jones gazed at it wearily. "Fish go in schools, don't they?" he asked.

"I think so," said Smith. "Why do you ask?"

"Oh, nothing much!" said Jones. "Only I was thinking you must have broken up an infants' class."

* * * *

"My son's saxophone lessons have been a very good proposition."

"Has he been able to get into a good band?"

"No; I've been able to buy the neighbouring houses very cheaply."

A SOUND BARGAIN

He had answered an advertisement offering a second-hand car, and was being given a trial run.

"It's sound in every part," commented the would-be seller.

"So I hear," was the reply.

* * * *

Park Keeper: "What are you doing up in that apple tree?"

Boy: "There's a notice down there that says 'Keep off the grass.'"

* * * *

Father: "Not a very good report, my boy. Why can't you do as well as Harry Wells? I hear he is top of your form."

Son: "Yes, father, but you must remember that Harry comes from a clever family."

* * * *

Excited Professor (driving a high-powered car): "We've got it at last!"

Second Professor: "Got what?"

First Professor: "Perpetual motion; I can't stop the thing."

* * * *

Proud Father: "Yes, my youngest boy plays the piano like Paderewski."

Polite Friend: "You don't say so."

Father: "Yes, he uses both hands."

* * * *

"You mean to say that you paid seven-and-sixpence for that laying hen! Why, it's years old."

"I know it is; I wanted one that was experienced."

* * * *

"Where have you been for the last four or five years?"

"At the 'varsity, taking medicine."

"And are you quite better now?"

* * * *

Teacher: "What happened in 1564?"

Boy: "Shakespeare was born."

Teacher: "Correct. And what happened in 1570?"

Boy (after a pause): "Shakespeare was six years old."

* * * *

"A most difficult man to deal with," observed the doctor. "He's never satisfied."

"One of your impatients, doctor?" asked his companion.

* * * *

WHY THERE WERE NO SHARKS



Explorer: "Why are you so certain there are no sharks in this creek?"
Guide: "Because they're afraid of the crocodiles."

* * * *

He was visiting California, and remarked that the last town he had stayed in was San Juan.

"San Huan, we Californians call it," gently corrected his friend. "We pronounce J like H."

"I beg your pardon," replied the traveller, "but I've only been here since Hanuary."

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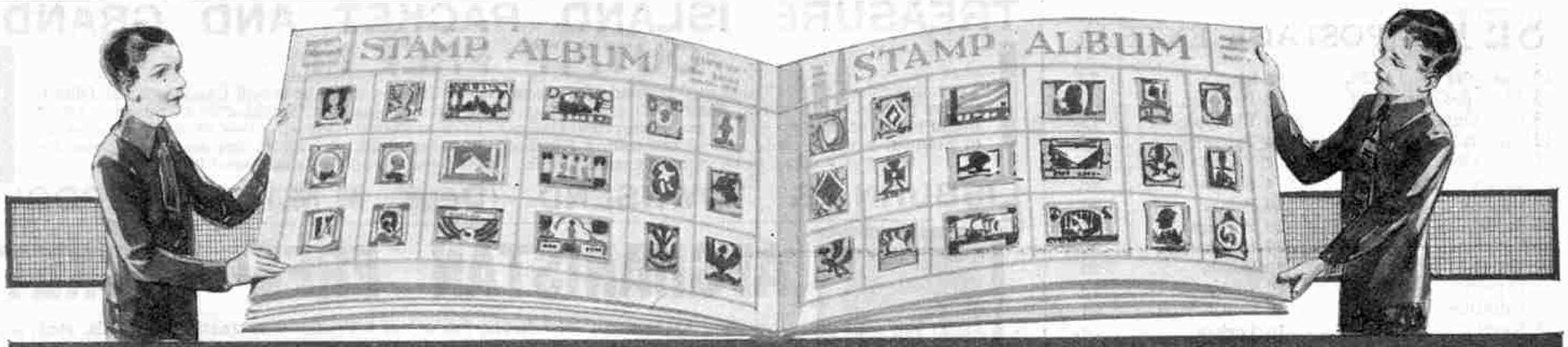
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STAMP COLLECTING

IDENTIFYING STRANGE STAMPS

NOTHING presents so many problems to the newcomer to stamp collecting as the identification of his stamps. Most albums sold for the use of young collectors are profusely illustrated, but when it is recalled that more than 56,000 stamps have been issued up to the present, it is obvious that the albums cannot do very much to help.

Unfortunately the difficulty is not one that can be solved by rule of thumb methods. Experience alone will overcome it, and experience can be gained most quickly by studying the illustrations of a good stamp catalogue such as Gibbons' or Whitfield King's, and by familiarising oneself with the names of foreign coinages. Careful examination of catalogue illustrations will reveal that most countries have certain "key" features of design that are repeated throughout their stamps, and when once those features are known, identification of all but out of the way states and countries becomes a matter of simple recognition.

Another useful idea is to learn the equivalent of the word "post" in the principal foreign languages, thus, *Postes*, French and Italian; *Correos*, Spanish; and *Correios*, Portuguese. This knowledge will permit many strange stamps to be placed immediately into a definite group of countries, and from that point a process of elimination will quickly arrive at the correct country. For example, the majority of South American countries use the Spanish or Portuguese languages.

Belgique	Belgium
C.C.C.P.	Russia (Soviet)
Ceskoslovensko	Czechoslovakia
Chine	French P.O.'s in China
Comunicaciones	Spain
Congo Belge	Belgian Congo (Congo State)
Cote d'Ivoire	Ivory Coast
Danmark	Denmark
Dansk Vestindien	Danish West Indies
Deutsches Reich	Germany
Eesti (Post)	Estonia
Eire	Irish Free State
Emp. Ottomane	Turkey
Escuelas	Venezuela
España	Spain
État Ind(ependant) du Congo	Belgian Congo (Congo State)
Ethiopie	Abyssinia
G(ran)d Liban	Great Lebanon
Guinée Française	French Guinea
Guyane Franç(aise)	French Guiana
Helvetia	Switzerland
Hrvatska S.H.S.	Jugo-Slavia
Island	Iceland
Latvija (Latwija)	Latvia (Lettland)
Lietuva	Lithuania
Magyar (Kir.) Posta.	Hungary
Maroc	French P.O.'s in Morocco
Nederland	Holland
Ned(erl)(andsch) Indie	Dutch Indies
Norge	Norway
Österreich	Austria
P.C.C.P.	Russia (Soviet)
Poczta Polska	Poland
Postes Persanes	Persia
Poste Vaticane	Vatican City
Saargebiet	Saar District
Shqipenia (or Shqypnis or Shqyptare)	Albania
Somalia Italiana	Italian Somaliland
Sverige	Sweden
Toga	Tonga
Touva	North Mongolia (Republic of Tannou Touva)

The majority of our readers will know sufficient of the French language to recognise inscriptions in that tongue, and if it is remembered that many of the names of countries as we know them in their English form are differently rendered in the French merely by the substitution of the letter "E" for a final "A," the French-speaking countries will present few difficulties. Cases in point are Mauritania, *Mauretanie*, and Senegambia, *Senegambie*. One special peculiarity of stamps inscribed in French is that the name of the country often is not the first word of the inscription. Examples of this are *Établissements de l'Oceanie*, Oceanic Settlements; and *État Independant du Congo*, subsequently *Congo Belge*, Belgian Congo.

Broadly speaking, stamps may be divided into three main groups for the purpose of identification—those that do not indicate their origin in any way, for example, Great Britain; those that indicate their origin in Roman characters similar to those used in the English language, for example, Nederland (Holland); and those that use characters that are not familiar or in international use, for example, Russia.

Obviously groups one and three present the most difficulties. The first group is not extensive, and if catalogue illustrations and the names of the foreign coinages shown on these have been studied carefully, recognition will not be long delayed. The third group is rather larger, but the number of stamp-issuing countries adhering strictly to the use of what might be termed non-commercial alphabets is gradually diminishing. Several countries, Japan, China, Egypt and Turkey, for example, use both the national and Roman characters. In criticising the use of national characters only, it should be kept in mind that postage stamps are primarily for internal use, and necessarily must bear characters that will be readily understandable by the people for whose use the stamps are issued.

The principal of these strange alphabets are (1) Arabic, used by Egypt, Hejaz-Nejd, Syria, Turkey; (2) Greek, Crete and Greece; (3) Chinese and Japanese, China, Korea and Japan; (4) Russian, Bulgaria, Far Eastern Republic, Finland, Jugo-Slavia, Russia, Trans-Caucasian Federation and Ukraine. Among the countries and states using national alphabets are Abyssinia, Afghanistan, and the Indian Native States. Of the last-named, Gwalior overprints native characters on the ordinary Indian issue.

We have included in these lists only countries that are likely to be encountered in a new stamp collector's early experience. There are many others that might be included, but are omitted as they are not likely to be met with before the collector has gained sufficient experience to deal with them confidently.

Several of the countries using strange alphabets retain distinctive features of design that simplify identification. In the first section Turkey, for example, always includes the national emblem, the Star and Crescent. Many Turkish issues include Roman as well as Arabic characters, as is the case with all modern Egyptian and Syrian issues. In its most recent issues Hejaz-Nejd also has used Roman characters for the name, and the earlier issues are notable for their intricate geometrical and scroll designs.

In Section 2 Crete and Greece have many similarities in design, but the name inscriptions are easily distinguished. The Crete inscription resembles the Roman characters KPHTH, while Greece may be rendered ΕΛΛΑΣ.

In the Chinese and Japanese section little difficulty will be experienced. China invariably uses Roman characters for denominating the value of its stamps in dollars or cents, while the Japanese national emblem, the chrysanthemum, is incorporated in all its designs. Korea, prior to the amalgamation of its postal service with that of Japan in June, 1905, included its name in Roman characters.

Section four cannot be simplified so readily as sections 1 to 3, although Soviet Russian issues can be identified immediately by the characters PCCP or CCCP that are their common features. Finnish issues for some 20 years before the War bore a very close resemblance to the contemporary issues of (*Cont'd on page 806, col. 3*)

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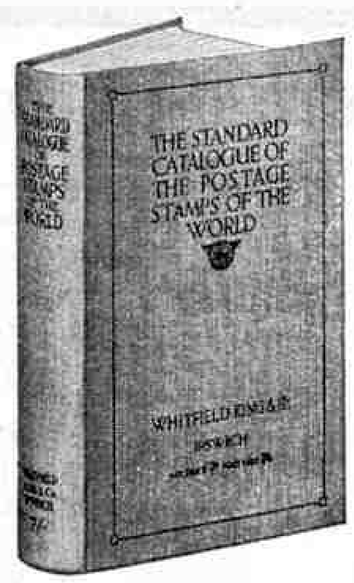
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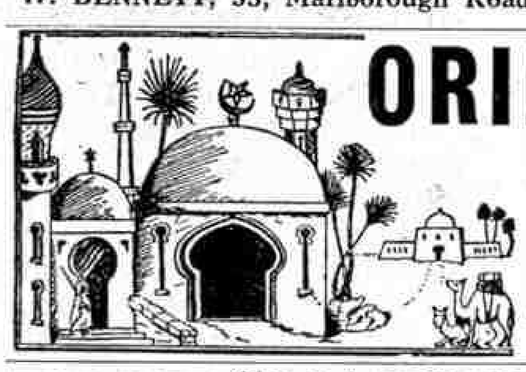
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Stamp Gossip

and Notes on New Issues



Lifeboat Stamps

Several interesting additions to a collection of shipping stamps are available this month. Holland has issued a charity series in aid of the work of the lifeboat service, while a breeches buoy rescue is the subject of one design in an Iceland charity issue.



The Dutch series contains four stamps with designs as follows :—1½c. + 1½c., a projected lifeboat service memorial at Helder. The monument is to house a carillon and be equipped with a battery of searchlights for use on fête days ; 5c.+3c., the hospital missionary ship "*Hope.*" Note the Æsculapian staff, the symbol of medical aid, in the left background ; 6c.+4c. (illustrated), an old-fashioned oar-propelled lifeboat ; 12½c.+ 3½c., a lifeboatman and, in the background, a Mariner's Home.

The Iceland issue is devoted to charity generally. It also consists of four stamps, the design illustrated here being used for both the 10 and 35 aur values. The word "*Slysavarner*" at the foot signifies National Safety Association. The 20 aur value shows children gathering berries on a hillside and bears the caption "*Barnahæli,*" Child Welfare. The fourth stamp, a 50 aur value, shows an old man standing on a seashore watching the setting sun. This value is inscribed "*Ellihæli,*" Aid for the Old Folk.

The 1934 Whitfield King Catalogue

The arrival of the 1934 edition of Whitfield King's Catalogue is a pleasant reminder that another stamp season has arrived. For the first time the actual lists of stamps in this catalogue have spread themselves over 1,000 pages of type matter, the total number of stamps listed having increased by 1,660 to 56,874. The catalogue illustrates over 6,400 of these.

Europe is shown to be, as usual, the most prolific stamp issuing continent, with a total of 17,860 stamps, and is followed by Africa, 12,684 ; Asia, 10,438 ; America, 9,680 ; West Indies, 3,333 ; and Oceania, 2,879.

The simple easily-grasped data provided by the Whitfield King catalogue make it an ideal guide for the general stamp collector. Well-meaning uncles seeking for a good gift for a stamp-collecting nephew need go no further in their search. The price is 7/– from any stamp dealer or book seller, or 7/6, post free, from Messrs. Whitfield King & Company, Ipswich.

Newfoundland Air Mail Set

Newfoundland has long enjoyed a great reputation for the excellence of its stamp productions, but that record is not sustained by the new air mail issue. The designs are "sketchy," to the point of crudeness in certain cases.

The series consists of five stamps, 5c. to 75c., with designs depicting the everyday use of aeroplanes in the life of the Dominion. The 5c. value shows a covey of ptarmigan put to flight by a passing machine, presumably carrying sportsmen to their shooting box. The 10c., possibly the best design of the series, depicts a lake scene with two men fishing from a canoe. Ashore is their companion cooking over a camp fire, and resting on the lake is the seaplane in which the party arrived.

The 30c. stamp, illustrated here, carries a touch of humour. It shows a sealing vessel, held in the ice pack, and an aeroplane arriving with the mail from home. In the foreground a hunting party are gathered around an air hole waiting for a seal to pop up its head and take its death blow. The seal obviously has other ideas, for it has elected to use another hole, and in the stamp it is shown surveying the proceedings with what surely is a cynical grin on its face!



The 60c. stamp shows a mail seaplane arriving alongside a fishing schooner, while the highest value, 75c., shows a flight of machines carrying stores to a mining party in the heart of Labrador.

A Century of Progress

The most interesting of recent United States commemoratives is the two-stamp set issued in connection with the Great World Exposition now in progress at Chicago. This exhibition is to mark Chicago's growth from the wooden-palisaded Fort Dearborn of 1833 to the mighty city of 1933, and the theme is excellently depicted in the stamps, both of which are illustrated here. The 1c. value shows Fort Dearborn, the original Chicago settlement built in 1804, and the 3 cent. stamp the magnificent Chicago Federal Building standing in the Exhibition grounds.



* * * *

Austria has issued a special stamp series to commemorate the 250th anniversary of the delivery of Vienna from the Turks. There are six stamps in the series, each bearing a design depicting a leading personage or important incident in the seige of 1683. The denominations are 12, 24, 30, 40, 50 and 64 groschen, to be sold at double face value. The issue is limited to 50,000 sets.

A South African Commemorative

South Africa intends to celebrate the centenary of the Voortrekkers by the erection of a monument to their memory, and to assist in the collection of funds for this purpose an issue of commemorative stamps is to be made each year for five years. Each stamp will be sold at a premium, the premium being devoted to the Centenary Fund. The first issue, from which we illustrate the 2d. + 1d. value, has just appeared. It consists of three values, 1d. +½d., 2d. + 1d. and 3d.+1½d.



The Voortrekkers were Boer farmers who, dissatisfied with the British administration in the Cape Colony, decided to cut themselves free and settle elsewhere. The first parties set out in 1835, and despite the disasters that attended their adventure, the Trek movement continued for three years, the principal settlements established being in Natal and the Orange Free State.

The only means of travel was by ox-wagon, and the 1d. value shows such a wagon on trek. The illustration is of a wagon, still in existence, that took part in the Great Trek and came through the Battle of Blood River. Its hood and body are in a splendid state of preservation and still bear traces of the holes made by assegais in the course of the fight between the Voortrekkers and the Zulu tribes. The 2d. value shows a typical Voortrekker and is drawn from one of the four figures at the base of the Kruger monument at Pretoria. The 3d. value depicts a Voortrekker woman.

It is a pity that the quality of production is not all that could be desired, for great care has been taken to secure accuracy in these designs.

A Manx Air Mail Stamp

The Manx people, with an eye to the publicity value of such an issue, have endeavoured for many years to persuade the postal authorities to sanction the issue of special stamps for the Isle of Man. Now they are within reach of at least partial success, for it is understood that authority is to be given for an air mail issue for use on mail that will be carried by the recently inaugurated Liverpool–Blackpool–Douglas air service.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

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101, Green Street, Forest Gate, London, E.7.

FREE GIFTS
How to obtain
A STAMP ALBUM FREE
Write for particulars and
44-PAGE BUMPER BARGAIN LIST
D. A. BERRY, Member British Philatelic Assn., 19, CORPORATION STREET, MANCHESTER.

VATICAN PACKET FREE!

A fine packet of all different stamps containing a fine **Vatican State** unused, **Jamaica 2/-, Crete, Paraguay, Brit. Honduras, Kouang-Tcheou, Turkey, Cameroon, Brit. Guiana, Prussia Official, Ceylon.** Free to all asking to see my famous approval sheets and **enclosing 2d. for postage (abroad 6d. P.O.).** Albums from 1/4 upwards.
[S. HAMMOND, CHESHAM FIELDS, BURY, LANCS.

REBOTCO

stands for October **backwards**; but from October **onwards,** I want to add your name to the list of satisfied customers, buying regularly from my 4-a-penny selections.

L. D. MAYNARD
78, RICHMOND ST., SOUTHEND-ON-SEA.

GIANT STAMP ALBUM FREE!!



THE "VANBRUGH GIANT" ALBUM
(8½ × 6 inches).
Holds **2,700** Stamps and has **150** illustrations. It is beautifully bound in STOUT PICTORIAL COVER, and includes full index. It contains much useful information, also three SPECIAL ARTICLES of interest to the collector. In addition, every Album contains a fine Pictorial ANDORRA VALLEY stamp to go on the first page. Do not miss this great offer, which is **ABSOLUTELY FREE** to all who request approvals and enclose 4d. stamp for postage and packing.
SHOWELL BROS. (M.M.25),
42, VANBRUGH HILL, LONDON, S.E.3.

FREE! 7 GREECE pictorials (1927)

To Genuine Applicants for my "Peak" Approvals.
S. BACKHOUSE, 61, WARNER STREET, DERBY.

510 STAMPS FREE!

This huge parcel contains stamps from Jamaica, **Travancore,** Old Japan, Br. S. Africa, **Prussia, Schleswig,** Hong Kong, etc. Just send 2d. for postage and request our Famous Extra Large Discount Approval Sheets. (Abroad 6d. P.O.)

LONGBOTTOM & EASTICK,
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The MADRID Packet

This super packet contains a fine set of the **Madrid Exposition Issue** (large Stamps), Morocco, Barbados, splendid **Egyptian Air Mail,** showing Pyramids and Aeroplane, Italian Commemoratives, Jugo-Slavia, etc. To all applicants for our BARGAIN Approvals, this packet is sent FREE and POST FREE.
HEWSON & SAYWELL, ABINGDON, BERKS.

"WORTH WHILE"

100 DIFFERENT BRITISH COLONIALS 1/- Post Free

including Gold Coast pictorials, ½d., 1d., 1½d., 2d.; N. Rhodesia, 1d., 2d.; Nigeria, ½d., 1d., 1½d., 2d., 3d.; Mauritius, 2, 4, 5c.; Iraq, ½, 1, 3 annas; N. Zealand, ½d., 1d., 1½d., 2d., 3d., 4d., 6d., 1/-. Newfoundland, Palestine, Jamaica, Fiji, Bahamas, etc. etc. Finest packet YOU have ever had. MONEY BACK if not satisfied. Ask for "Worth While" Approval Sheets.
JOS. H. GAZE, DIDSBURY, MANCHESTER.

TRIANGULAR PACKET FREE!

This wonderful packet contains a **Mint Triangular Iceland Airmail** (Icelandic Falcon), **Triangular Fiume** (Steamboat), and 20 other interesting stamps including **Commemorative** Issues from **Italy** (**Fascisti** and **Founding of Rome**), **Cochin, Ukraine** (two large mint pictorials), a large Mint Airmail, **Charkari** (pictorial), **Johore** (bi-coloured), **Nicaragua** (**One Peso Mint**), also mint High Values, British and French Colonials, etc.
FREE to all genuine Approval Applicants enclosing 2d.
Send for this Magnificent Free Gift To-day!!
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Sir Humphrey Gilbert Commemorative Stamps will remain on sale only five months, and should be obtained NOW as they will doubtless prove an excellent investment. We offer the complete mint set of 15 Stamps (1–32c.) for **7/6**, or set to 10c. (9 Stamps) for **2/6**, POSTAGE EXTRA. The **1933 Air Stamps** (set of 5) are also available (mint) at **9/-** the set. Send 2d. for our detailed price list of **Canada and Newfoundland** Stamps.
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OLD ENGLISH PENNY POSTAGE STAMPS FREE
Issued nearly a century ago. A set of English stamps including 7 postage stamps issued and used postally in **1841, 1856/8, 1858/79, 1887** and **1902** with 3 other stamps (**5/-, 10/- and £1**), issued and used for a special revenue purpose, will be given free of charge to applicants for specially cheap selection of stamps on approval. Big discount.
Very Special. Belgian Parcels Post 1923/31. Fine Set of 20 (including surcharge) 10c. to 20 francs. Price **6d.** Postage extra.
Henry Turner, 110, Barnett Rd., Preston, Brighton, Sussex

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to purchasers from our world-famed approval Sheets. Send for approval sheets and full particulars to Department 229. *Established 1880.*
ERRINGTON & MARTIN, South Hackney, London, E.9.
Those sending a stamped addressed envelope will receive free three handsome Pictorial new issues.

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MANY RARE STAMPS have been found by purchasers of **The "DIAMOND" Packet,** which contains approx. **1,000 UNSORTED STAMPS** from Convents abroad.
1 pkt. 1/3. 3 pkts. 3/6. 5 pkts. 5/6.
All post free. (Abroad 3d. per pkt. extra.)

O. NERUSH
(Dept. "L"), 68, TURNPIKE LANE, LONDON, N.8.

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This Amazing Offer consists of the following **43 all diff. high class** stamps, and every stamp is a genuine postal used copy. There are **NO** German or damaged stamps: **10 India** (including **5 'Service'**), Set **5 Africa** (Pictorials, etc.), Set **7 Japan** (Cat. 8d.), Set **3 Irish** (½d., 1d., 2d.), Set **4 Canada, 2 U.S.A.** (Bi-Centenary), **2 Old Nigeria, 2 Obsolete Gold Coast, 2 Australia, New Zealand, Scarce Ceylon, Kenya and Uganda, Egypt, Malay** (Tiger), **Belgium, 1f., 75c.** (Cat. 2d.), **ALL FREE** to **Genuine** Approval Applicants **sending** 2d. postage.
PUCKA STAMP CO., 27, NORMANDY AVE., BARNET.

20 AIR MAILS—FREE
To Applicants for my approvals. Includes GOYA AIR, MOROCCO, DANZIG, ROUMANIA, etc. A fine lot. Please send 2d. for postage. Purchasers of 1/6 will receive further handsome gift. Particulars with approvals. **HUGHES, 7, WINCHESTER ROAD, N.W.3.**

100 DIFFERENT STAMPS FREE. Send for ½d. Approvals.—Cox, 21, Dennis Mansions, Westcliff.

1,000 ASSORTED STAMPS. Many scarce, 2/- and FREE GIFT.—BM/NLRE, London, W.C.1.

62/- for 5/-. 3 Belgium c. 28/6, 2/6; 4 Port. Cols. c. 8/3, 9d.; 2 C. America c. 13/6, 1/-; Post 1½d., 5/- lot.—N. Loseby, Retford.

KINGS' HEADS, Colonial and Foreign Duplicates for disposal. One Farthing per stamp. Send postcard for trial.—Philatelist, 32, Josephine Av., Brixton, S.W.2.

FREE—9 KENYA (1c-50c)

To applicants for Bargain Approvals enclosing 1½d. post.
COX & SON,
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POCKET STAMP WALLET FREE!
Size 5¾ × 3¾ (with strip pockets). Pkt. of Mounts, Perf. Gauge and a FINE EMBARGO Collection of 25 Soviet Russia Pictorials. **All Free** to genuine Approval applicants sending 2d. postage (without approvals, 1/6).
North Wales Stamp Co., Dept. M. 25, Lawson, Colwyn Bay.

All Different. **Interesting Stamps.** Postage Extra. 15 Exhibition, 1/-; 22 Ships, 1/-; 16 Maps, 1/-; 15 Colonial Commemoratives, 1/-; 5 Servia Death Mask 1/-; 19 Italian Commems., 2/-; 41 ditto, 4/-; 5 Roumania Scouts, 2/-; 25 Charity Cat. about 14/-, 2/6.
N. LOSEBY, 39, CAROLGATE, RETFORD, NOTTS.

Stamp Collecting—(*Continued from page 803*)

Russia, but since 1917 it has been the practice to indicate the name in Roman characters. Issues from the Ukraine, other than a charity issue in 1923, incorporate a trident device.

The remaining countries in this section, and all of those in the fifth, cannot be indicated quite so readily, and the only course is to memorise the characteristics of the catalogue illustrations.

The second main group of countries—those using Roman characters and indicating their origin in names more or less familiar to British boys—is comparatively straightforward. As we have already said, careful study of catalogue illustrations will do a tremendous amount to aid easy recognition, but in the centre panel of page 803 we give a list of the inscriptions that are most likely to present difficulties. The portions in parenthesis are occasionally, but not consistently, omitted.

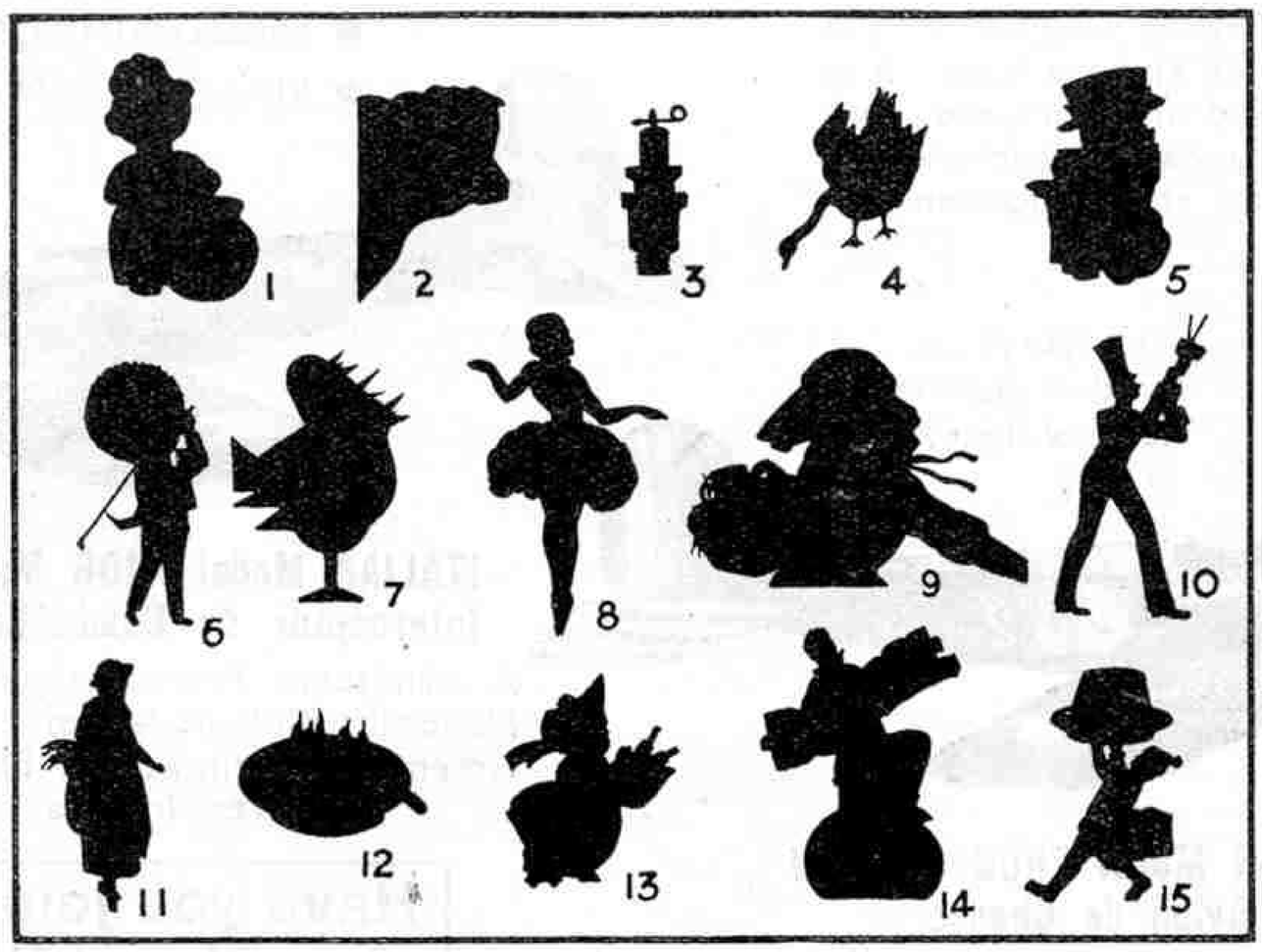
Competition Corner

WHAT ADVERTISED PRODUCTS ARE REPRESENTED HERE?

Some time ago we held several competitions in which readers were required to identify the advertised products represented by a number of silhouettes of well-known advertising figures and mascots. These competitions were particularly successful, and we have been repeatedly asked to arrange others on similar lines. This month, therefore, we announce another silhouette contest.

The figures included in the accompanying illustration are all well known in present-day poster and other advertising, and each one is a genuine silhouette reproduction of a portion of an advertisement.

Competitors are required to state the product advertised by each figure, and the name of the advertising firm. The panel should not be cut out from the page, but the items should be numbered to correspond with the numbers in the illustration.



The competition will be divided into Home and Overseas Sections, in each of which prizes of Meccano products to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four most accurate lists in order of merit. In addition there will be a number of consolation prizes. The term "Meccano products" covers all goods produced by Meccano Ltd., and the winners will be allowed to choose whatever they wish to the value of their prizes from the current Meccano price lists.

Entries must be addressed: "Silhouettes, Meccano Magazine, Binns Road, Liverpool 13," and must reach this office not later than 31st October. The closing date for Overseas entries is 31st January, 1934.

October Colour Drawing Contest

It is several years since our artist readers were restricted to the use of colours in a "*M.M.*" contest, but this month that restriction operates, for the subject is a reproduction in colour of any illustration—except the cover—from this month's magazine. There is no restriction as to the colour medium. It may be paint, crayon or ink.

The entries, as usual, will be divided into two sections, A for those aged 16 and over, B for those under 16, and prizes of Meccano products or Artist's Materials—to be chosen by the winners—to the value of 21/– and 10/6 will be awarded in each section.

Competitors may submit as many entries as they wish, but may not receive more than one prize. Each entry must bear the competitor's name, age and address on the back. It is not sufficient to state merely the section.

Entries should be addressed "October Drawing Contest, Meccano Magazine, Binns Road, Liverpool 13," and must reach this office not later than 31st October. A separate set of prizes will be reserved for Overseas entries, which should arrive not later than 31st January, 1934.

Competitors are reminded that entries will be returned only if a stamped addressed cover is sent. Prizewinning entries are retained by the Editor.

JUNE CROSSWORD PUZZLE

■	S	O	F	I	A	■	G	■	I	R	A	T	E	■
C	■	R	E	S	T	O	R	A	T	I	V	E	■	S
R	A	D	D	L	E	■	O	■	S	P	E	E	C	H
A	G	E	■	E	■	O	A	R	■	E	■	M	O	O
S	N	A	G	■	A	N	N	U	L	■	V	E	T	O
S	O	L	■	P	R	E	E	N	E	D	■	D	O	T
■	S	■	H	I	S	■	D	■	T	E	N	■	N	■
S	T	E	E	L	E	D	■	S	T	A	I	N	E	D
■	I	■	W	O	N	■	S	■	E	L	L	■	A	■
I	C	E	■	T	A	M	P	E	R	S	■	R	S	M
L	I	N	G	■	L	U	R	E	S	■	M	I	T	E
I	S	M	■	H	■	M	A	R	■	I	■	P	E	N
A	M	I	C	E	S	■	I	■	A	D	D	E	R	S
D	■	T	A	B	E	R	N	A	C	L	E	S	■	E
■	S	Y	R	E	N	■	S	■	T	E	N	T	S	■

The Overseas section now having closed, we are able to publish the solution to the June Crossword Puzzle.

Competition Results—(*Continued from previous column*)

Canada); 3. K. Ogilvie (Germiston, Transvaal); 4. N. V. Eustis (Alberton, Sth. Australia). Consolation Prizes: W. Hanson (Ottawa, Canada); T. Sanh (Hong Kong, China); E. Feltham (Moonah, Hobart, Tasmania); G. Muller (Vivorata, Argentina).

April Photo Contest.—First Prizes: Section A, A. A. Boult (Auckland, N.Z.); Section B, T. R. Johnson (Vancouver, B.C.); Second Prizes: Section A, L. W. Humm (Geraldine, N.Z.); Section B, S. S. Sacks (Cape Town).

COMPETITION RESULTS

HOME

July Photo Contest.—First Prizes: Section A, D. E. Cooper (Witham); Section B, P. T. Clarke (East Sheen, S.W.14). Second Prizes: Section A, J. Robertson (Dalmuir); Section B, D. H. Peed (Streatham, S.W.16). Consolation Prizes: D. Burton (Caterham Valley); S. Garbutt (Altrincham); W. M. Hunter (Lewisham, S.E.13); H. G. Morgan (Salisbury).

May Doublets Contest.—1. D. L. Brewer (Gainsborough); 2. A. L. Beattie (Sydenham, S.E.26); 3. D. T. Broadbent (Shrewsbury); 4. F. Spiegelhalter (Barnstaple). Consolation Prizes: R. S. P. Branson (Newton St. Cyres); J. Garlick (Leigh-on-Sea); G. R. Petrie (Goodmayes).

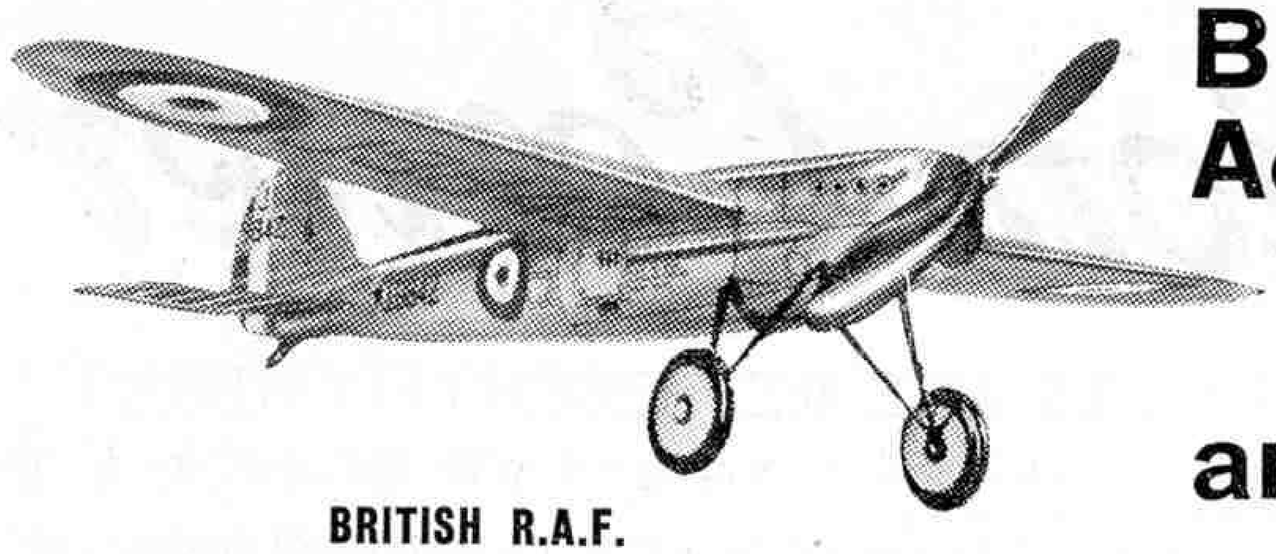
OVERSEAS

Cover Voting Contest.—With the publication of the results of the Overseas Section of this contest it is interesting to compare the voting in this and the Home Section. It will be noted that there are several very interesting differences. Home Voting:—October; August; December; June; November and March (tie); May; September; January and February (tie); April; July. Overseas Voting:—October; December; August; September; June; July and November (tie); February and March (tie); January and May (tie); April.

The prizewinners' names are as follows:—1. L. Gue (S. Edmonton, Alta.); 2. Miss D. Coppens (Pretoria); 3. J. Stocker (Christchurch, N.Z.); 4. D. Tolkowsky (Palestine). Consolation Prizes: P. Brain (Southern Rhodesia); J. Cesak (Winnipeg); W. Jack (Victoria, Australia); G. Muller (Vivorata, Argentina); O. Studd (Winnipeg); C. R. Wallace (Sea Point, C.P.); J. W. W. Wilkinson (Toronto); A. Winskell (Auckland, N.Z.).

March Drawing Contest.—First Prizes: Section A, J. S. de Conti Manduca (Sliema); Section B, J. R. Thomas (Regina, Sask.). Second Prizes: Section A, M. S. Ayson (Invercargill, N.Z.); Section B, N. Scully (Singapore). Consolation Prize: D. Brown (Brantford, Ont.).

March Aerodrome Errors Contest.—1. M. S. Ayson (Invercargill, N.Z.); 2. E. J. Pankowski (Toronto,



BRITISH R.A.F.

The original model, in Silver, Red and Blue.

The FROG is the ONLY Flying model Aeroplane that really resembles a full size machine. It is scientifically designed and manufactured with meticulous care and accuracy and is revolutionary in design, construction and performance.

Buy a *flying model* Aeroplane — buy a 'FROG' and be proud of it!

- SCIENTIFIC DESIGN
- EXCELLENT PERFORMANCE
- REALISTIC APPEARANCE



ITALIAN Model FROG Mark IV
Interceptor da Combattimento

A handsome reproduction in full National Colours :—Red, White, Green, Pale Yellow, and Blue with correct Insignia.

Wing Span 9½ ins.
Length of Flight 300 ft.
Height of Flight 70 ft.



FRENCH Model FROG Mark IV
Avion de Chasse

Exact replica in full Colours :— Dark Green, Red, White and Blue and correct Service markings.

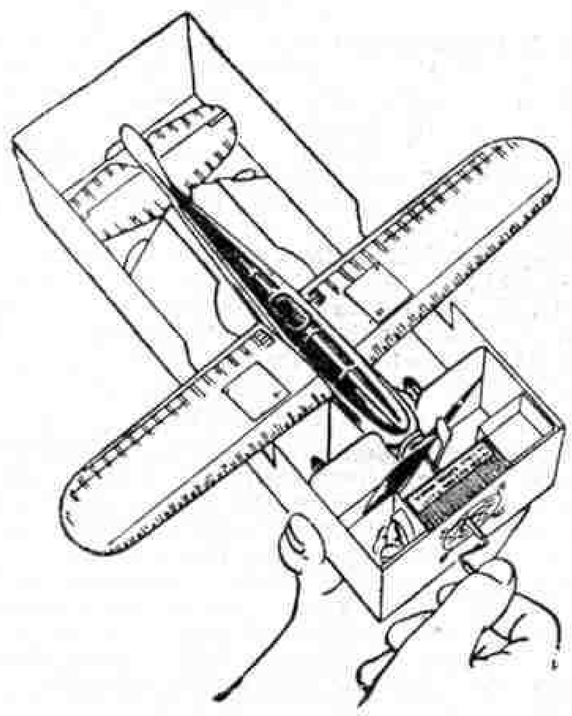
Have you joined the FROG Flying Club yet?

The object of the Club is to encourage owners of FROG Model Aircraft to obtain best results from their machines.

Handsome enamelled badges are given to those who are successful in passing the necessary proficiency tests.

Your dealer will give you full particulars and entry forms, or you can write to us direct for them.

World patents granted and pending



Can be completely wound for flight in patented container box in 15 seconds.

TRADE MARK REGD.



U.S.A. Model FROG Mark IV Single Place Pursuit Ship

A splendid Model of an American Military Aeroplane beautifully produced in the correct Colours and Squadron markings.

Models not illustrated :—

ARGENTINE (Silver, Blue and Black).
BELGIUM (Silver, Scarlet, Yellow and Black).
HOLLAND (in the full colours of a K.L.M. Air Liner).

All Models Price **7/6**

Complete with Mechanical Winder, Spare Motor, Frog Lubricant and Gear Box Oil.

BRITISH MADE by INTERNATIONAL MODEL AIRCRAFT

FROM ALL GOOD TOY SHOPS AND STORES

Sole Concessionaires:

LINES BROS. LTD., Tri-ang Works, Morden Road, London, S.W.19

Hamleys News

Estd 1760

·HAMLEY·BROTHERS·LTD

Number Six *October, 1933*

SENSATIONAL NEW TOYS AT HAMLEYS

See the Finest Display of Models and Toys in London!

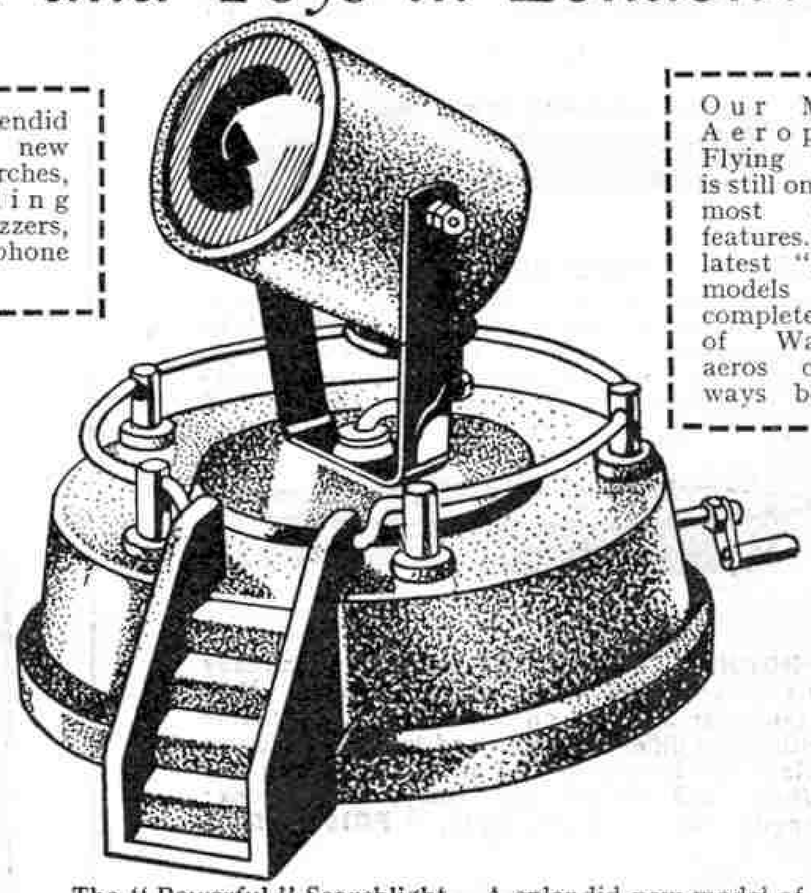
FAMOUS MODEL RAILWAY NOW IMPROVED AND RE-EQUIPPED

A whole lot of splendid new toys and models have arrived at Hamleys. Trains and Boats of all kinds, motor cars, soldiers, guns, tanks, searchlights and aeroplanes. An amazing array all ready for you to come and see. The magnificent electrically operated model railway has been completely re-conditioned, and with its numerous stations and net-work of sidings it is easily the finest model railway in London. Working models of Meccano are continually being demonstrated, and in addition there is a large Hornby train system, with a complete range of locomotives and accessories in stock. Be sure and visit Hamleys. Remember it is the finest toy shop in the world.

SEE THE NEW MECCANO MOTOR CARS ALSO KEMEX AND ELEKTRON OUTFITS

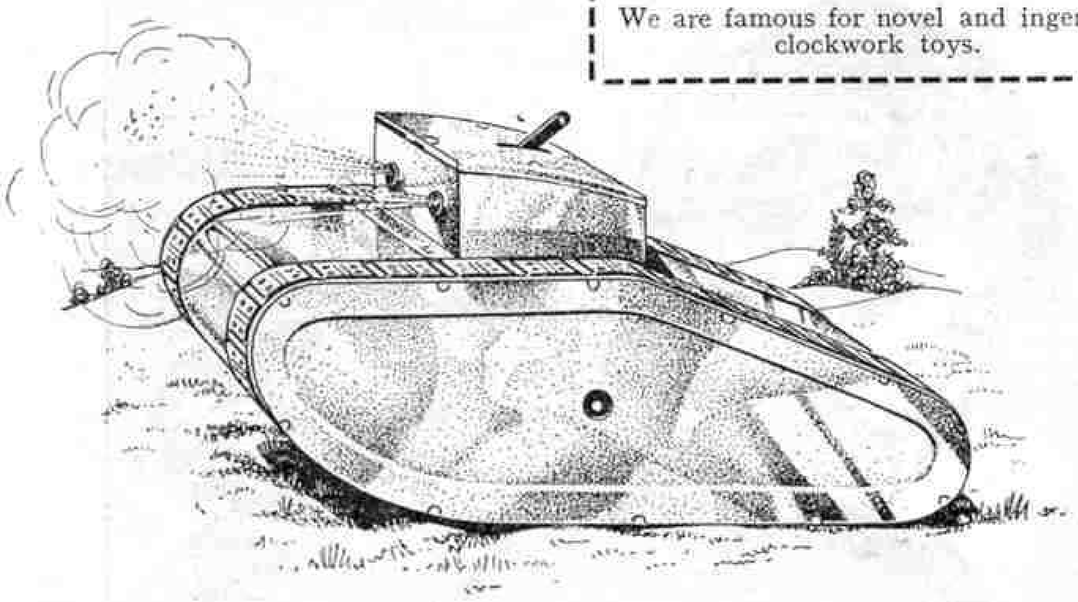
See the splendid range of new Electric Torches, Signalling Lamps, Buzzers, and Telephone Sets.

Our Model Aeroplane Flying Ground is still one of our most popular features. The latest "FROG" models and a complete range of Warneford aeros can always be seen.



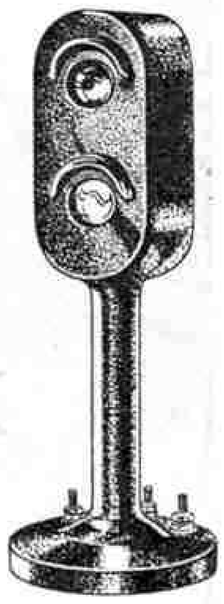
The "Powerful" Searchlight. A splendid new model of realistic appearance, heavy cast metal base with steps and gallery. Lamp swivels completely round and is readily adjustable to throw light at any angle. Special lens projects an extremely powerful concentrated light. The battery is concealed in the base and is easily accessible. Size of base 4" diameter. Height to top of light 4". Diameter of lens 1¾". Finished in battleship grey. Complete with battery. Postage 9d. extra. **Price** 5′6

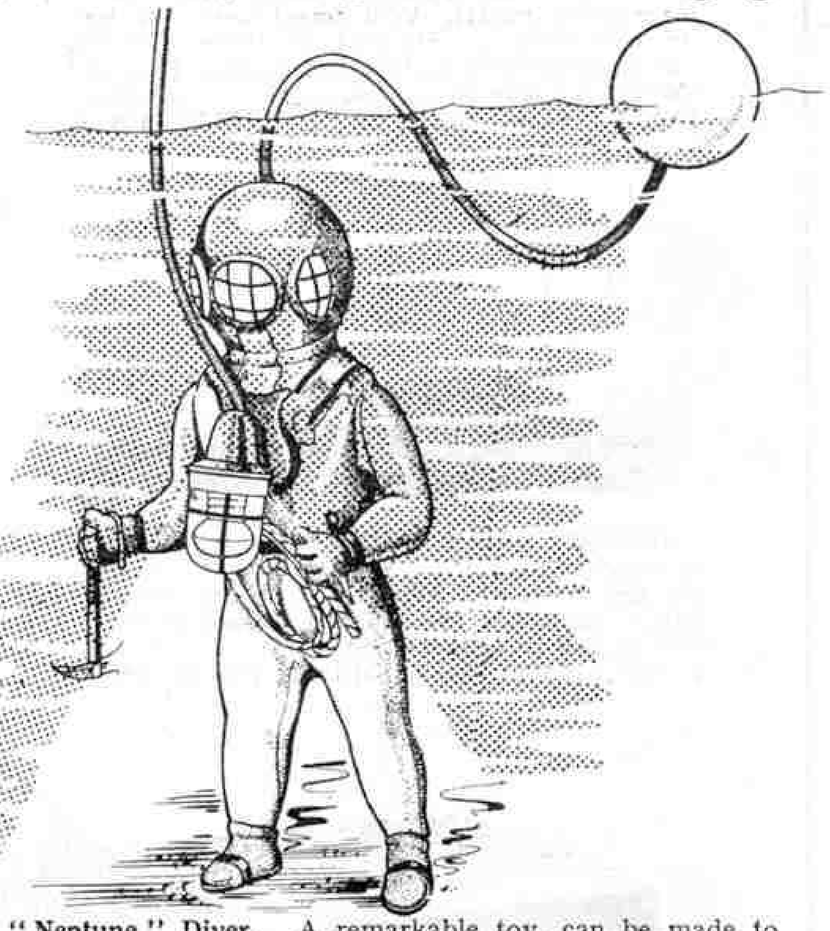
We are famous for novel and ingenious clockwork toys.



The "Sharp-Shooter" Tank. A novel new clockwork toy of realistic appearance. Gives brilliant flashes from the dummy gun turret, and imitation firing noise. Length 7½".

Price 2′11
Postage 4d. extra.



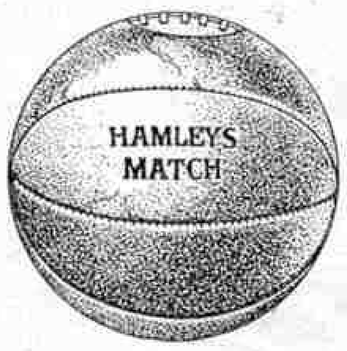


The "Neptune" Diver. A remarkable toy, can be made to submerge and ascend like a real diver. Strongly made of metal, and attractively finished in green and blue with coppered helmet. The diver is complete with hatchet and electrically lit water-proof lamp, which is operated by a small battery above the surface of the water. Height 7½". Complete with control tubes and bulb.
Postage 9d. extra. **Price,** including battery, 8′6

The "Match" Association Football. In really heavy quality hide, machine sewn 8-panel, fitted with same quality bladder as in our best Match balls.

Size 5—**Price** 5′-

Size 4—**Price** 4′6
Postage 6d. extra.



Electric Railway Signal. A new illuminated signal for all model railways. Strongly made and finished in black. Height 4".

Price 3′3

Switch for same **10½d.** Postage 4d. extra.

"Cranbourne" Hockey Stick. A well balanced stick, strongly made for hardest wear. Double-spring handle and full length rubber grip.

Price
Postage 9d. 10′-

Toys, Models, Sports and Games Hamleys **200-202, REGENT ST., LONDON, W.1**

THE FINEST TOY SHOP IN THE WORLD.

HORNBY SPEED BOATS



HORNBY SPEED BOAT No. 1. A very efficient model measuring 8½ in. in length and 2⅜ in. in beam. Will travel over 160 feet on one winding. Finished in three different colour combinations—Red and Yellow, Blue and White, and Orange and Green. **PRICE 3/11**



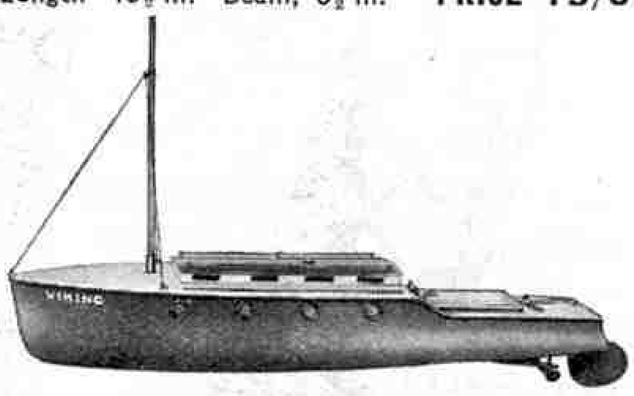
HORNBY SPEED BOAT No. 2. One of the most popular of the Hornby models. Will travel over 300 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Yellow and White. Dimensions: Length, 12½ in. Beam, 3 in. **PRICE 7/6**



HORNBY SPEED BOAT No. 3. Has already established itself as a great favourite. Will travel over 500 feet on one winding. Available with three different names and in three different colour combinations—Red and Cream, Blue and White, and Green and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in. **PRICE 12/6**



HORNBY LIMOUSINE BOAT No. 4. A magnificent model. Will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions: Length 16½ in. Beam, 3½ in. **PRICE 15/6**



HORNBY CABIN CRUISER No. 5. A model of outstanding merit. Will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in. **PRICE 16/6**

THE BEST THAT YOU CAN BUY

Nothing like the 1933 Hornby Speed Boats has been known before in model speed boat construction. They are superb! Each model follows closely the design and general characteristics of the world's famous speed boats. All possible skill and ingenuity has been employed in the manufacture of these new speed boats.

Perhaps the most outstanding features are the excellent streamlined hull and fine entry lines of bow giving greater speed. No less important is the amazing length of run due to the fine mechanism by which the boats are propelled, and the unique methods of construction of the hull. A specially designed propeller ensures that turn of speed so vital when competing in local speed boat races.

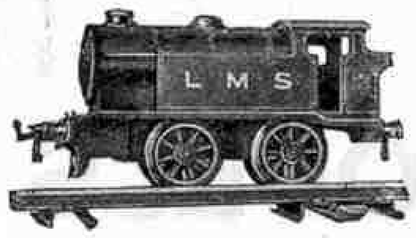
Ask your dealer to show you the 1933 Hornby Speed Boats.



Manufactured by

MECCANO LTD., Binns Road, Liverpool 13

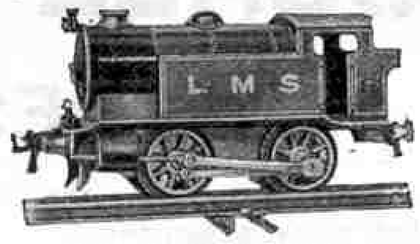
HORNBY TANK LOCOMOTIVES



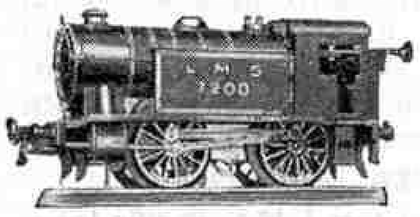
M3 Tank Locomotive

M3 TANK LOCOMOTIVE. This is the powerful Locomotive (reversing) supplied with the Hornby M3 Tank Goods Set. It is a handsome and extremely reliable model that will give long and excellent service. Available in either red or green. **Price 7/6**

No. 1 TANK LOCOMOTIVE. This strong and durable Locomotive is capable of any amount of hard work. It is fitted with brake mechanism and reversing gear, and is supplied in colours to represent L.M.S.R., L.N.E.R., G.W.R. or S.R. Locomotives. **Price 13/6**



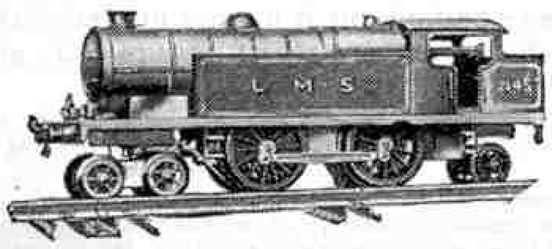
No. 1 Tank Locomotive



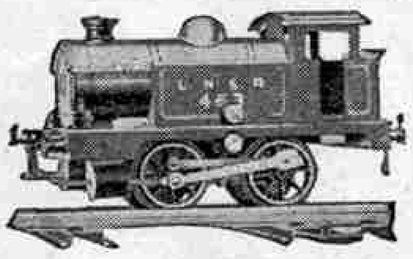
No. 1 Special Tank Locomotive

No. 1 SPECIAL TANK LOCOMOTIVE. This splendid Locomotive which is fitted with brake mechanism and reversing gear, has remarkable power and gives a very long run. It is available in the colours of the L.M.S.R., L.N.E.R., G.W.R. and S.R. **Price 18/-**

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No. 2 Special Tank Locomotive



No. 1 Electric Tank Locomotive

No. 1 ELECTRIC TANK LOCOMOTIVE. This Locomotive is of the permanent magnet type, and may be run from a 6-volt accumulator. It can be stopped, re-started, reversed and the speed varied by the operation of levers at the side of the track. It is supplied with a terminal connecting plate, speed and reverse control switch and 3 feet of flex, and it is available in the colours of the L.M.S.R., L.N.E.R., G.W.R., and S.R. Locomotives. **Price 32/6**

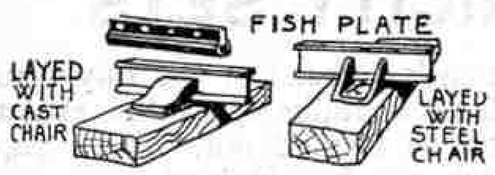
This Locomotive cannot be run from the mains supply.

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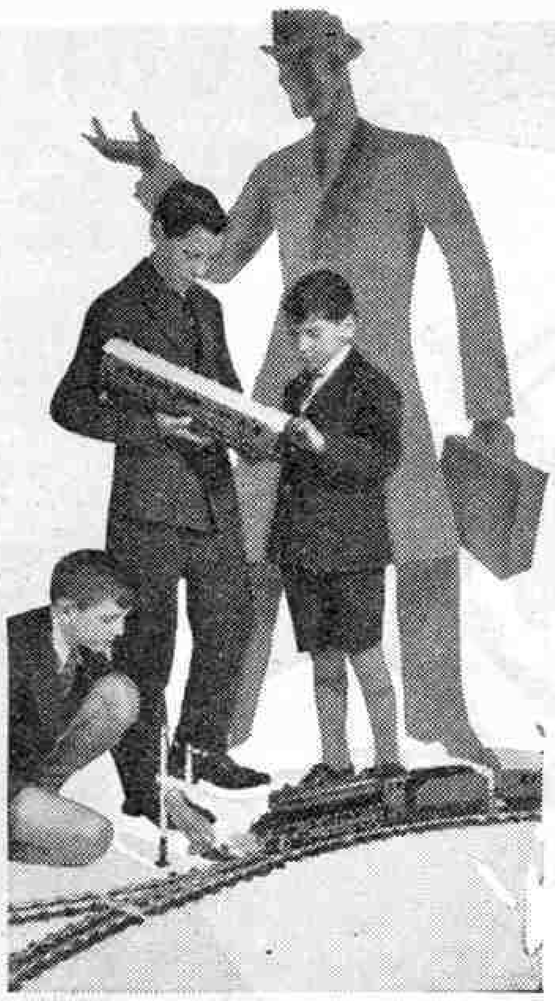


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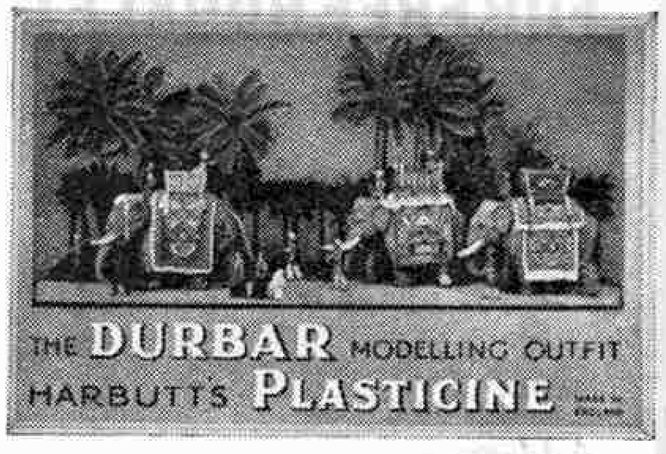
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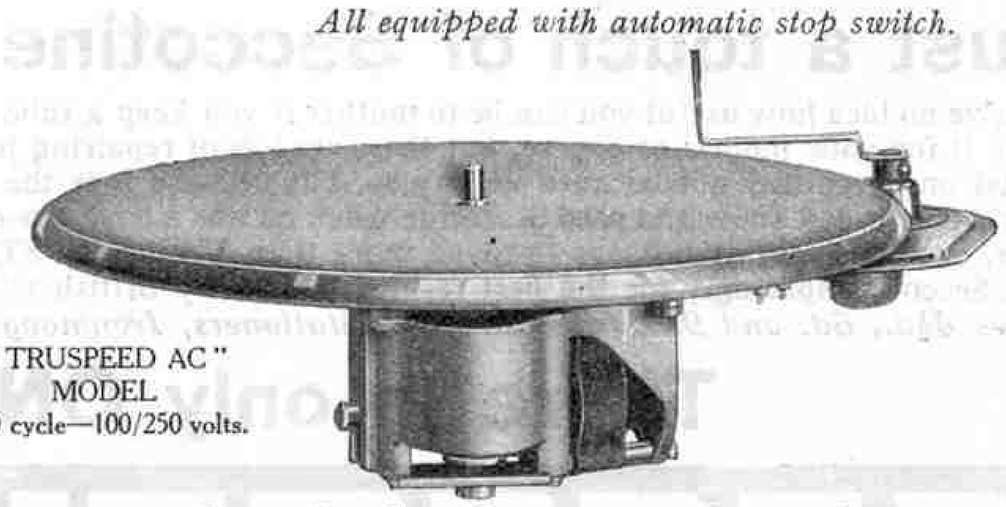
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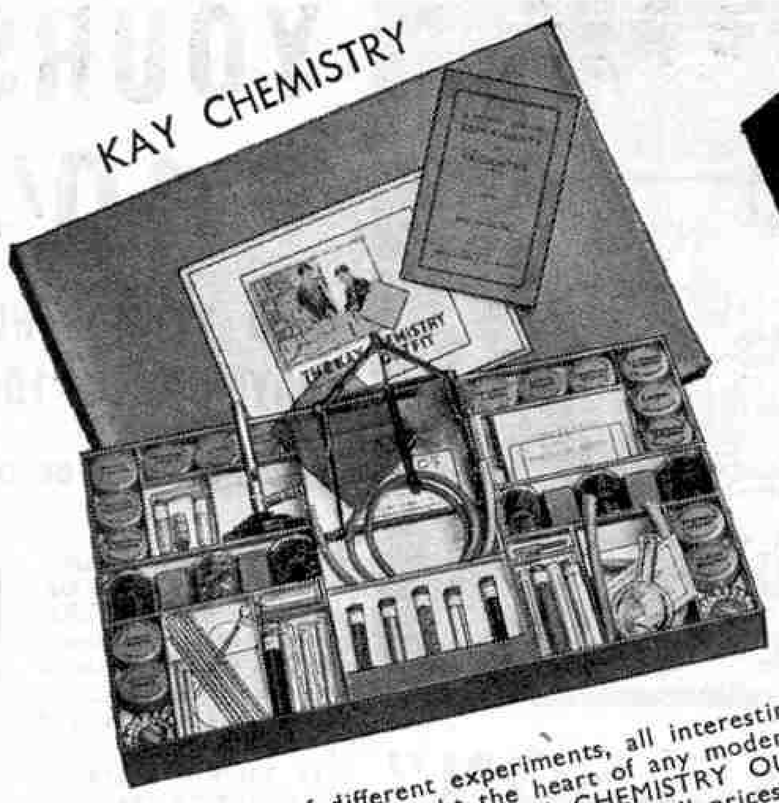
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If you prefer to do so, you can effect the exchange through your dealer, who will be very pleased to give you any information you require.

EXCHANGE YOUR OLD HORNBY LOCOMOTIVE TO-DAY !

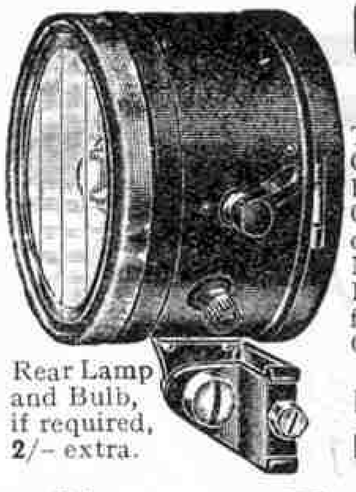
Part Exchange Allowances for Hornby Locomotives

CURRENT TYPES	
MO Locomotive	1/4
M1/2 Locomotive	2/3
M3 Tank Locomotive	3/9
No. O Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
LEC 1 Locomotive (Swiss Type)	7/6
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
LST M3/20 Tank Locomotive (20-volt)	11/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
LST 1/20 Tank Locomotive (20-volt)	12/6
LE 1/20 Locomotive (Swiss Type), 20-volt	13/3
LE 2/20 Locomotive (20-volt)	16/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera " Blue " Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera " Blue " Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan L.V. Locomotive	20/–
OBSOLETE TYPES	
M2930 Locomotive	1/–
George V Locomotive (These models were identical)	3/3
No. OO Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
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FOR YOUR CYCLE

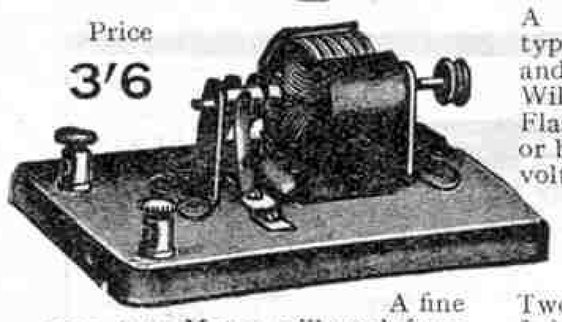
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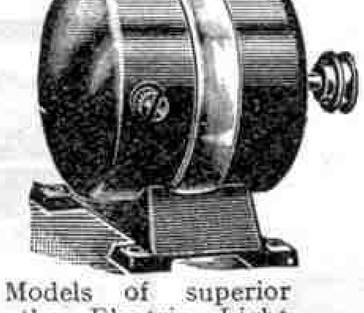
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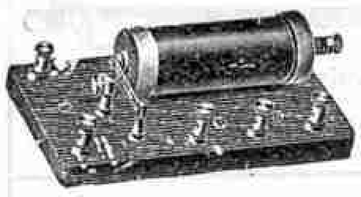


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1/50 h.p. with Gearing. Price **28/6**

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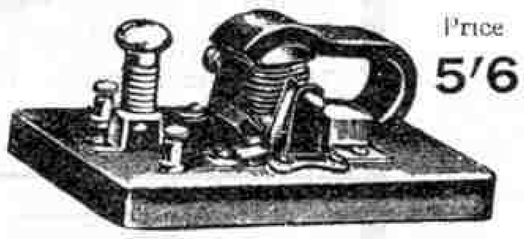


Price **3/-**

This fine coil is a wonder—works from a Pocket Lamp Battery.

DYNAMOS

Price **5/6**

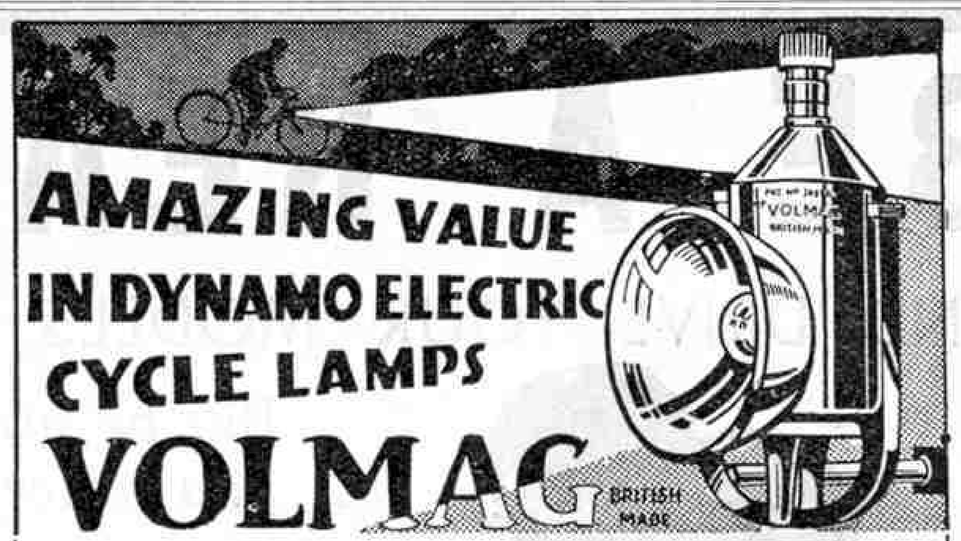


A strong Dynamo that will light up your Models or Railway with a 3.5-volt Bulb easily. Base 4¼" × 3".

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Any order over 10/- sent post free, otherwise 6d. extra, abroad 1/-.

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AMAZING VALUE IN DYNAMO ELECTRIC CYCLE LAMPS

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BRITISH MADE

British Patent No. 348973

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Mr. E. R. Upwell, nr. Wisbech, writes :— "It is a wonderful invention and **big value for money."**

SUPERSEDES BATTERY LAMPS

Produces its own light by movement of the cycle—

No batteries to run down, or other expensive replacements.

No. VM/63 (as illustration) **6/3 post free**

No. VM/76 (as VM/63) but with large silver-plated reflector (dia. 2¾") **7/6 post free**

FITTED TO CYCLE IN A FEW MOMENTS

A Light Always Ready

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INVENTIONS (Manchester) LTD.
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8/- DOWN

brings immediate delivery of a Riley "Home" Billiard Table. You pay balance as you play.

7 DAYS

Free Trial. Rileys pay carriage and take transit risks.

Hours of endless enjoyment may be spent on a Riley Billiard Table—enjoyment in which all the family can participate. Father, mother, boys and girls will be equally keen on this popular pastime. But it should be played on a REAL Billiard Table and not a toy. Play it on a Riley, every model of which is a perfect replica in construction of a full size Billiard Table. Sizes and prices of Riley "Home" Billiard Tables are shown below, also the easy monthly payments.

4 ft. 4 ins. × 2 ft. 4 ins.	...	£7	0	0	or in	8/-
5 ft. 4 ins. × 2 ft. 10 ins.	...	£9	0	0	20	10/3
6 ft. 4 ins. × 3 ft. 4 ins.	...	£11	15	0	monthly	13/3
7 ft. 4 ins. × 3 ft. 10 ins.	...	£15	0	0	payments	17/-
8 ft. 4 ins. × 4 ft. 4 ins.	...	£21	10	0	of	24/6

DINE AND PLAY ON THE SAME TABLE

The Riley "Combine" Billiard and Dining Table offers something unique in house furnishing, combining in one a beautiful dining table and a flawless billiard table. After dining, it is ready in a couple of minutes for a delightful game of billiards.

Available in many attractive designs, oak or mahogany, for cash or on easy terms. Here are the sizes and prices for the round leg mahogany pattern.

32 FREE BILLIARD TABLES Write for details and free price list.

5 ft. 4 ins. × 2 ft. 10 ins.	...	£22	10	0
6 ft. 4 ins. × 3 ft. 4 ins.	...	£26	10	0
7 ft. 4 ins. × 3 ft. 10 ins.	...	£33	0	0
8 ft. 4 ins. × 4 ft. 4 ins.	...	£43	0	0

or in 13 or 20 monthly payments.

Rileys are the largest makers of Full Size Billiard Tables in Great Britain. Also specialists in accessories, re-covering tables, etc.



This is the Riley "Cabriole" design 6 ft. size, £34 10 0, or in 13 or 20 monthly payments.

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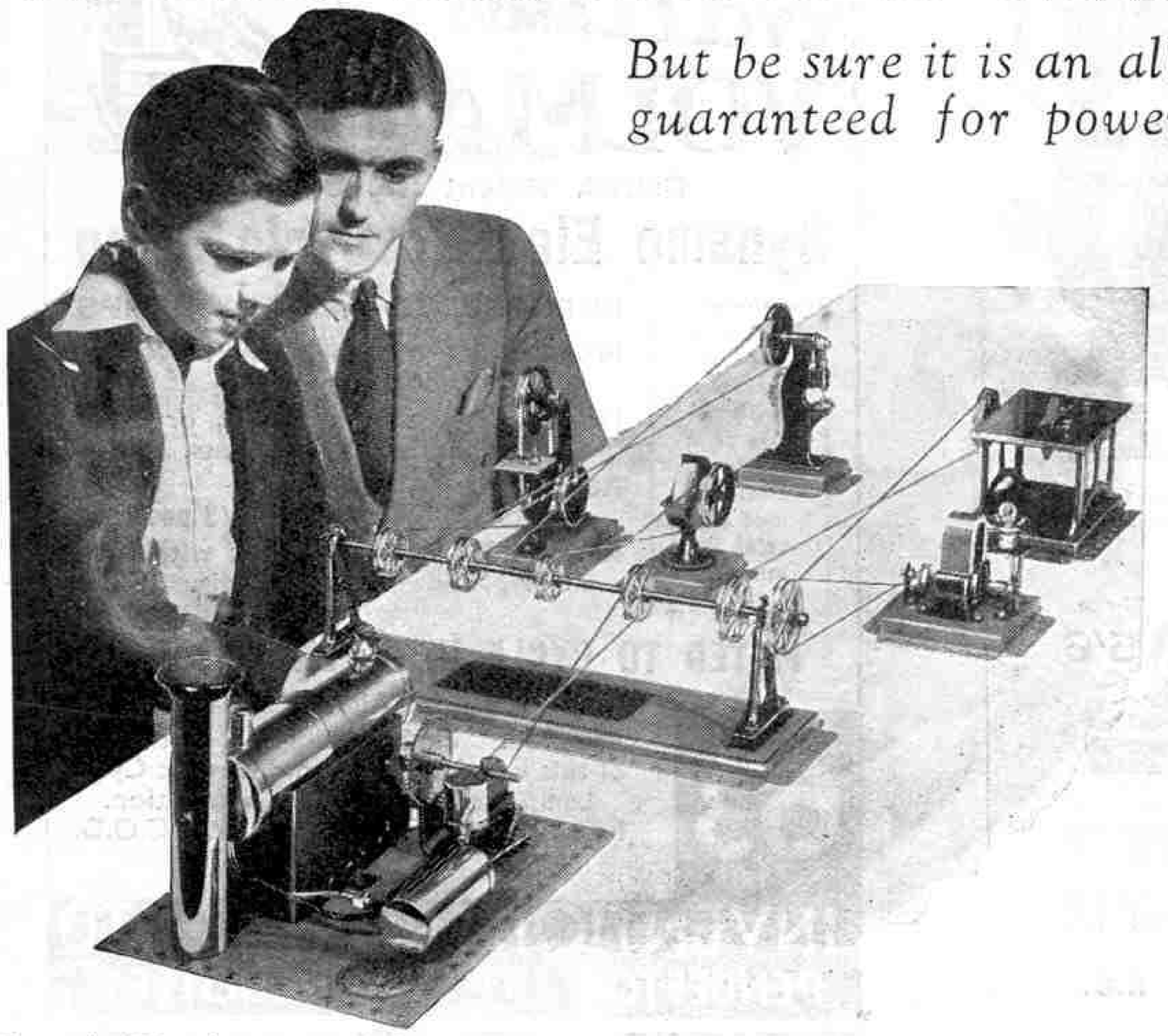
E. J. RILEY LTD., Deal Works, Accrington
and Dept. 4, 147, Aldersgate Street, London, E.C.1

Ⓟ4

BE A REAL ENGINEER

AND DRIVE YOUR MODELS BY STEAM—JUST LIKE REAL ONES

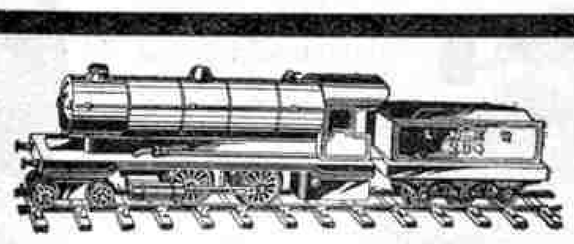
But be sure it is an all-British Bowman engine guaranteed for power, reliability and safety



Boys! Here's a workshop that **works.** Wheels turning, axles spinning, machinery in motion—all driven by a splendid steam power plant which will touch 2,000 revs. a minute.
There's endless fun in a Bowman workshop. Start one to-day! You can keep on adding extra models as you go along.

STATIONARY STEAM ENGINE (M135) Brass boiler, $5\frac{3}{4}'' \times 1\frac{3}{4}''$, with safety valve. 2-speed gear and two driving pulleys. Drip feed lubricator. Steam exhausts through chimney. Drilled metal base, Meccano pattern by permission. In box. Postage U.K. 1/-. Price **16/9**
(Other Steam Engines 6/9 to 37/6)

PRESS (Model 832) **3/3** **CIRCULAR SAW** (Model 833) **3/9**
BANDSAW (Model 834) **3/11** **GRINDSTONE** (Model 835) **2/9**
DYNAMO (Model 839) **7/6** (All working models postage 4d. extra)

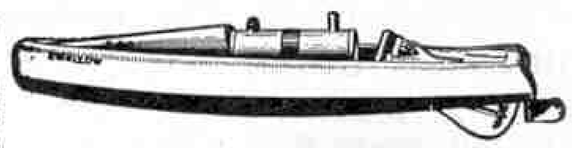


Runs $1\frac{1}{2}$ miles non-stop. Solid drawn brass boiler. Safety valve. Exhaust through chimney. 2 cylinders. Steel frame. Length with tender 20″.

LOCO 234 **30/-**

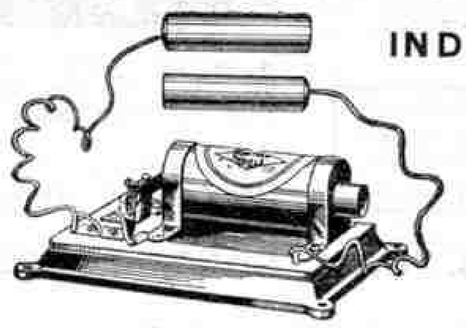
Other steam locos **10/6, 21/–, 25/–** Tender **7/6**

"SWALLOW"



Steams $\frac{3}{4}$ mile on one filling. Light wood hull 20″, beam $3\frac{1}{2}''$. Bowman engine. With safety valve and safety lamp.

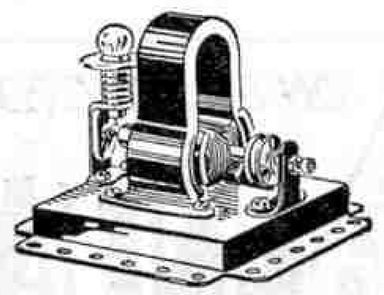
Other steam boats **22/6, 32/–, 42/–.** **17/6**



INDUCTION COILS

Astounding value. Polished bakelite box with variable current. Works from 4-volt battery or Dynamo. **3/6**

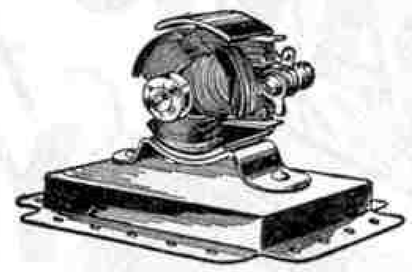
Dual coil model **5/–**



DYNAMO

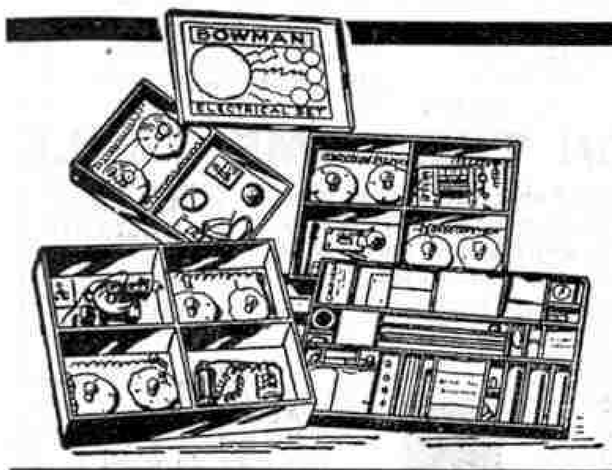
Super efficient dynamo on new principle. Gives bright light with smallest steam engine. Fitted drilled metal base, Meccano pattern by permission. With bulb—No. 839 at **7/6**

Also 840 at **5/–**



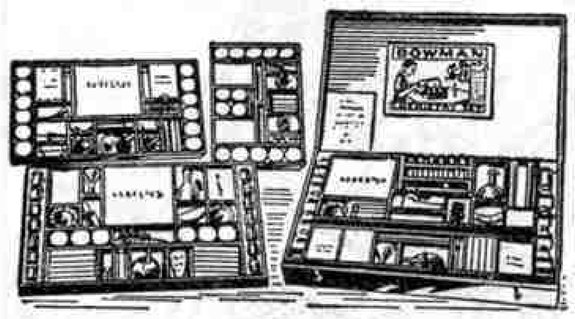
ELECTRIC MOTOR

For use with 4-volt battery or accumulator. Series wound for low consumption. Drilled base, Meccano pattern by permission. Suitable for boats. **4/6**



ELECTRICAL SETS

These new electrical sets are splendid value. Of two classes (a) practical application sets (b) experimental sets. Eight sets priced from **2/6 to 21/-**



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This amazing wooden cabinet, size $15'' \times 22''$, with all chemicals in glass, is offered at special price of **15/–.** See it before deciding.

Other models **2/6 to 21/-**

THE BOWMAN BOOK OF MODELS—an interesting treatise on model engineering and full details of all models—will be sent you by return of post if you send your name and address (and enclose threepence in postage stamps) to

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NONCLOG
makes the wheels whiz faster and with much less energy

GRADE A (Light) for ordinary use
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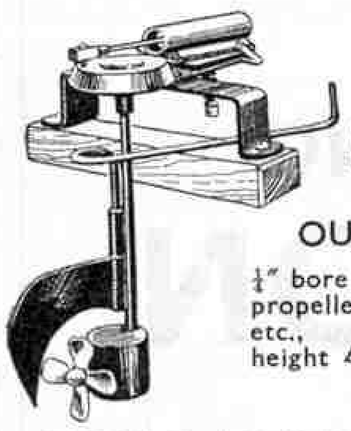


Ordinary cycle oils won't stand up to fast riding with modern cycles on fast roads. You're wasting your energy . . . . because of unsuitable lubrication.
Nonclog is the finest cycle oil in the world . . . because of higher viscosity it clings to bearings, reduces friction to a minimum, and remains efficient at highest speeds and over long distances. *Lubricate YOUR Cycle with Nonclog to-day . . . see the difference CORRECT LUBRICATION makes.*

NONCLOG
the CORRECT Cycle Lubricant

Obtainable from Halford's, Curry's and all cycle dealers.
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Chemico Works, Birmingham.

(Sells)



New Design Steam Engines



OUTBOARD ENGINES
¼" bore x ¾" stroke, complete with propeller and rudder, bevel drive, etc., as illustrated. Overall height 4½". **7/6**. Post 3d

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Oscillating type, 5/16" bore x ¾" stroke. Only 12 lbs. steam pressure required for this model. **4/6**. Post 3d.

DOUBLE ACTING OSCILLATING ENGINES, ⅜" x ⅜" ONLY 12 lbs. STEAM PRESSURE REQUIRED. **5/6**. Post 3d.

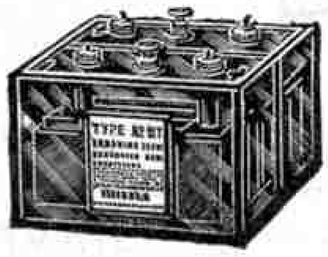
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1½" brass, **8d.**



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Complete with stern tube and glan.
Rigid type, 7" long ... **11d.**
Flexible, 9¾" long ... **1/-**

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4-volt, 6 amp. **6/6** each

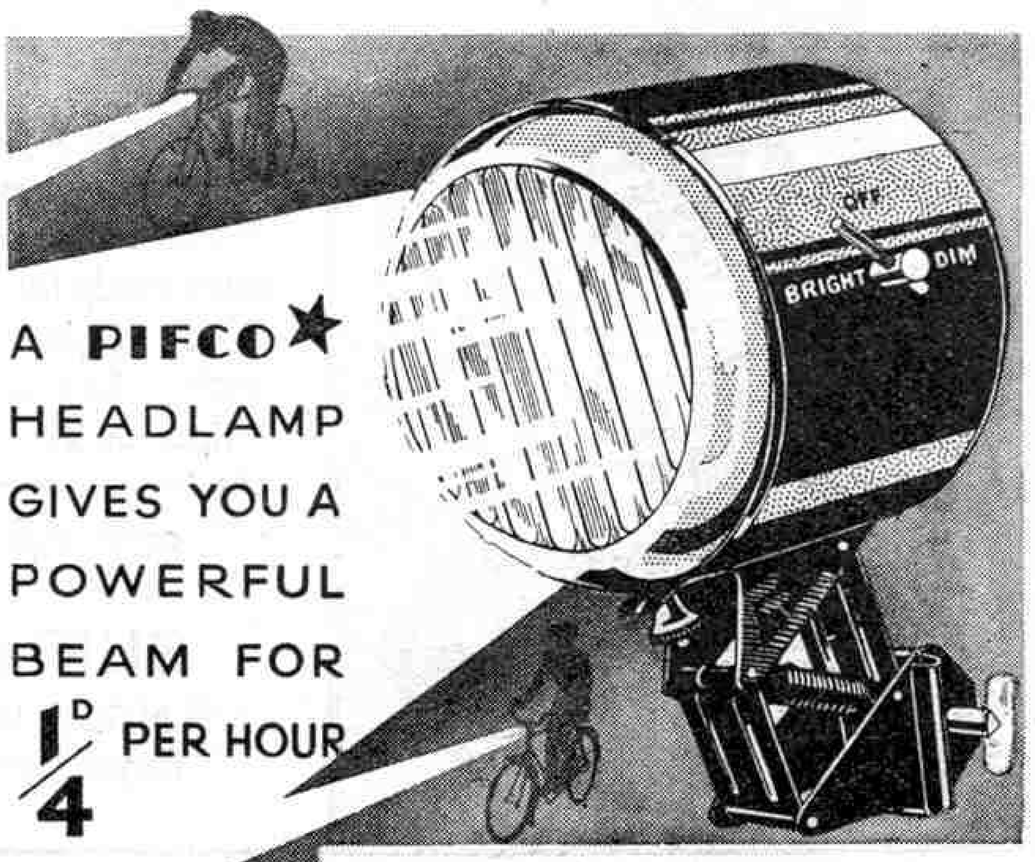


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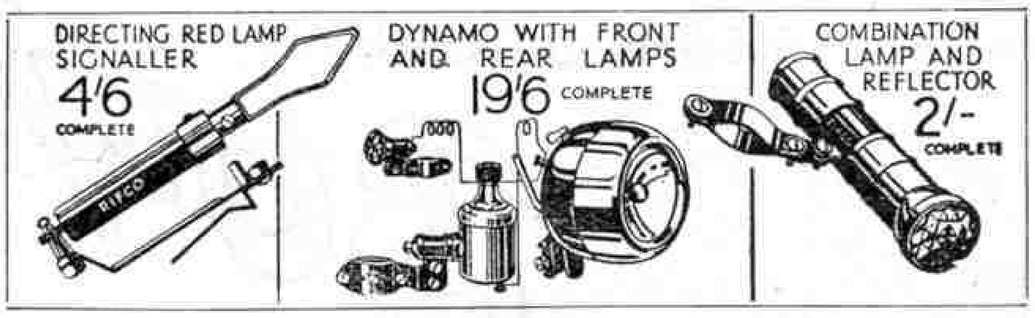


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Choose a Pifco Headlamp this autumn on account of economy and the safety it ensures. Study these features—90 ft. beam, 30 hours light from 2 pocket batteries, spare bulb carrier, faceted lens, Twin Switch, alternate current 4 or 8 volt. Decidedly **—the finest lamp in Britain,** and extraordinary value at

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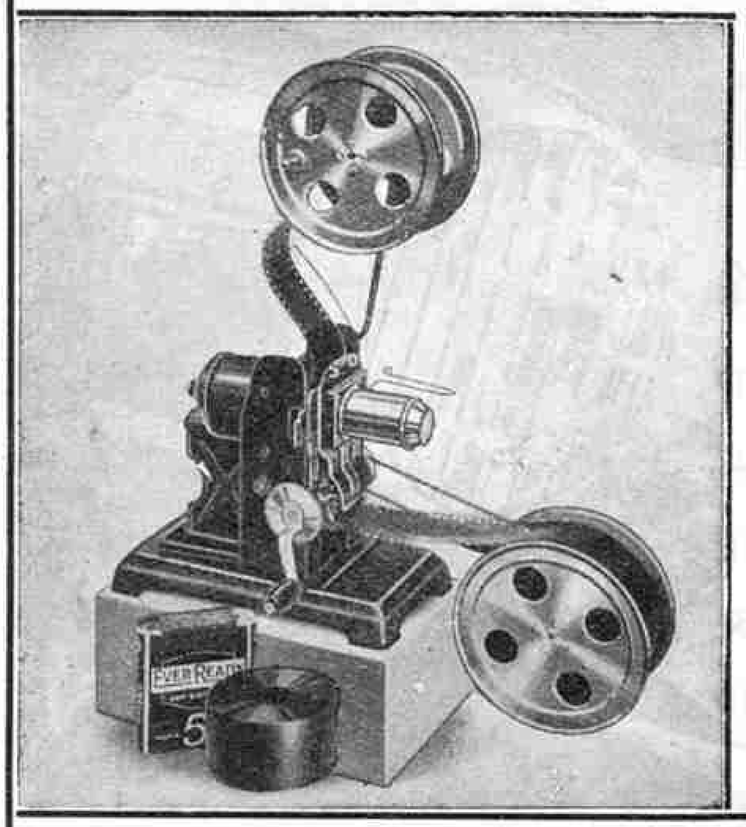
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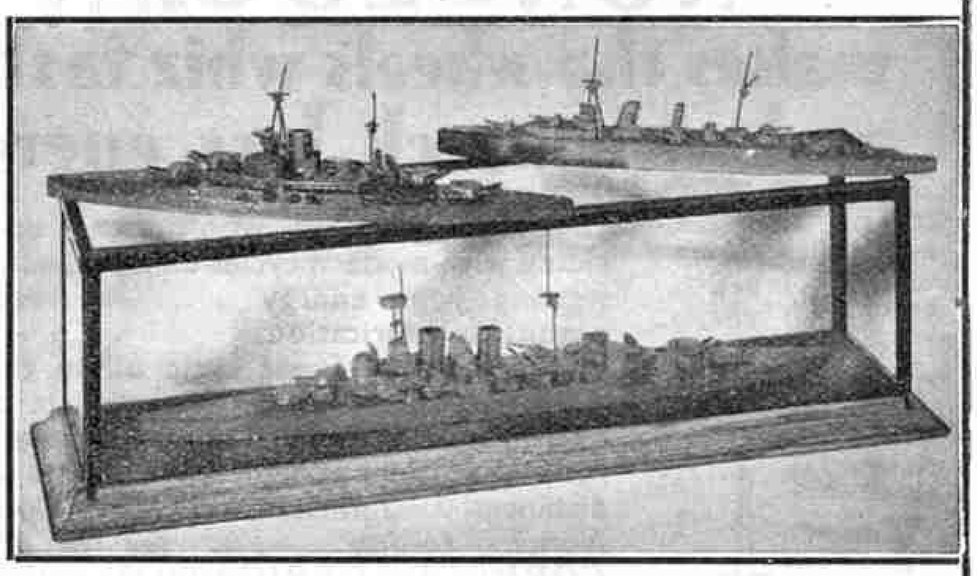
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The Aerodrome and Landing Field 43" x 36".

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Playing the great game of railways with a Hornby Train is the best fun in the world. The locomotives are fitted with powerful mechanisms that give great length of run, combined with exceptional pulling power. The comprehensive range of Hornby Rolling Stock, Accessories, Rails, Points and Crossings enables a boy to duplicate almost every operation employed in modern railway practice.

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PRICES OF HORNBY TRAINS

CLOCKWORK

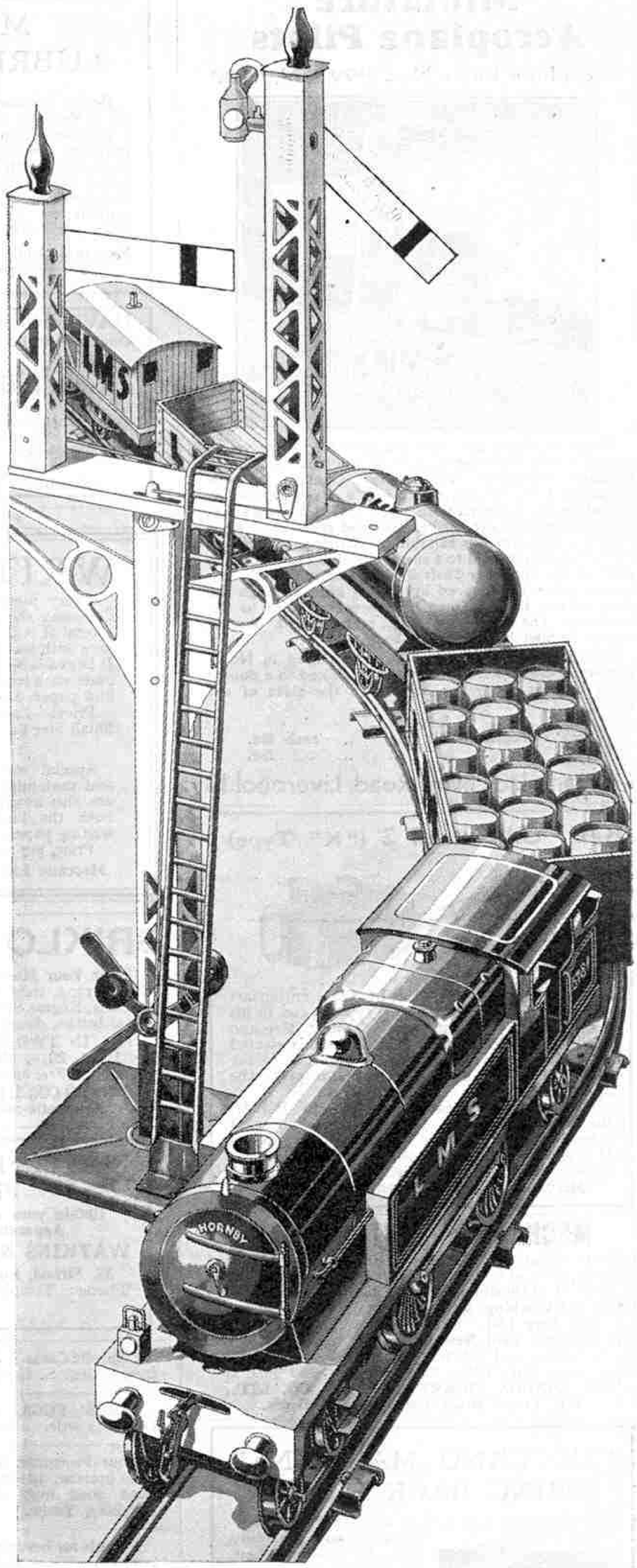
M0 Goods Set	5/–
M0 Passenger Set...	5/9
M1 Passenger Set...	9/3
M1 Goods Set	10/–
M2 Passenger Set...	10/9
M3 Tank Goods	15/–
No. 0 Goods Set...	18/6
„ 0 Passenger Set	17/6
„ 1 Goods Set	25/–
„ 1 Tank Goods Set	25/–
„ 1 Passenger Set	28/6
„ 1 Special Goods Set	32/6
„ 1 Special Passenger Set	35/–
„ 2 Mixed Goods Set	40/–
Metropolitan Train Set C	45/–
No. 3C Riviera "Blue" Train Set	62/6
„ 2 Special Pullman Set	67/6
„ 3C Pullman Sets. "Flying Scotsman," "Royal Scot," "Cornish Riviera" or "Golden Arrow"	67/6

ELECTRIC (6-volt)

No. E3/6 Train Set. Riviera "Blue" ...	80/–
„ E3/6 Pullman Sets. "Flying Scotsman," "Royal Scot," "Cornish Riviera" or "Golden Arrow"	85/–
Metropolitan Train Set, L.V.	85/–

(20-volt)

No. LST 1/20 Tank Goods Set	40/–
No. LST 2/20 Mixed Goods Set...	55/–

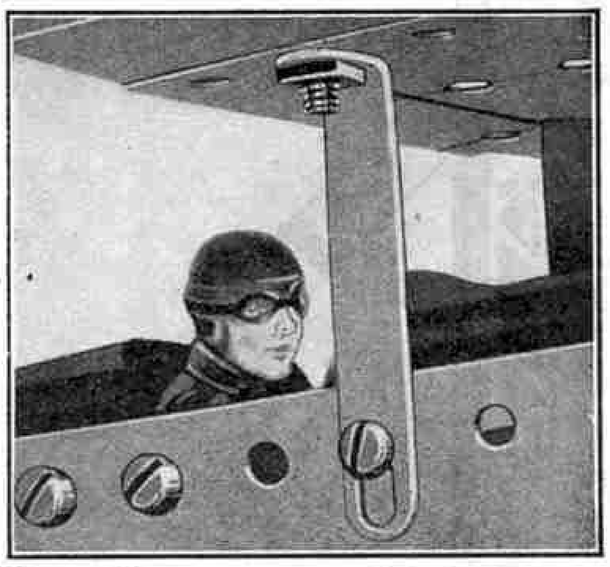


HORNBY TRAINS

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Miniature Aeroplane Pilots

Aeroplane Parts Nos. P99 and P100



Miniature Pilots are now available for fitting to all open cockpit machines built with the Nos. 0, 1 and 2 Meccano Aeroplane Constructor Outfits. These attractive little figures, which add a wonderful touch of realism, are supplied with green coat and orange cap, blue coat and red cap, or red coat and green cap. Aero Part No. P99, which is suitable for fitting to the No. O Outfit models, is fixed to a special bracket that takes the place of the Propeller Shaft Bracket in the Outfit. The special bracket is secured by passing bolts through the sides of the fuselage into the threaded holes in the bracket. The Propeller Shaft rests in the bearing socket formed in the Pilot's body.

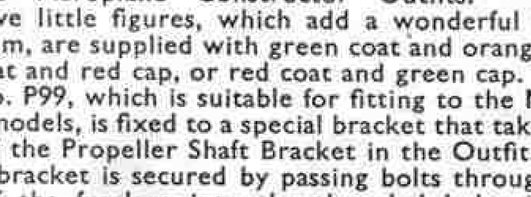
Part No. P100 (illustrated above) is used in No. 1 and No. 2 Outfit models. The Pilot is fixed to a double angle bracket ready for bolting to the sides of the fuselage.

Prices :

P99 Aeroplane Pilot ... ... each **5d.**
P100 ,, ,, ... ,, **5d.**

Meccano Ltd., Binns Road, Liverpool 13

OIL CAN No. 2 ("K" Type)



In Polished Copper

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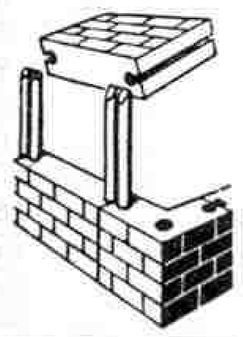
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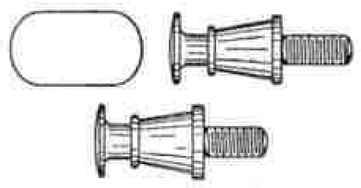
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THE RAILWAY MAGAZINE

PRINCIPAL CONTENTS
OCTOBER ISSUE

From Manchukuo to Moscow
New Tourist Trains, L.N.E.R.
Notable Stations and their Traffic: Willesden Junction
Fastest Trains in Great Britain
The Locomotives of the L.S.W.R. 1897-1923
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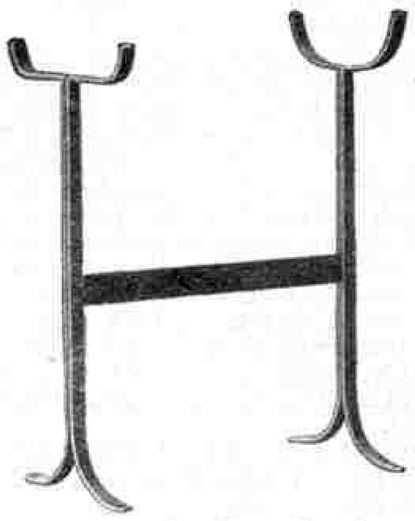
The above, fully illustrated, are in addition to the regular features such as "British Locomotive Practice and Performance" and "The Why and the Wherefore."

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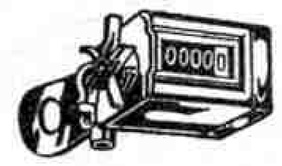
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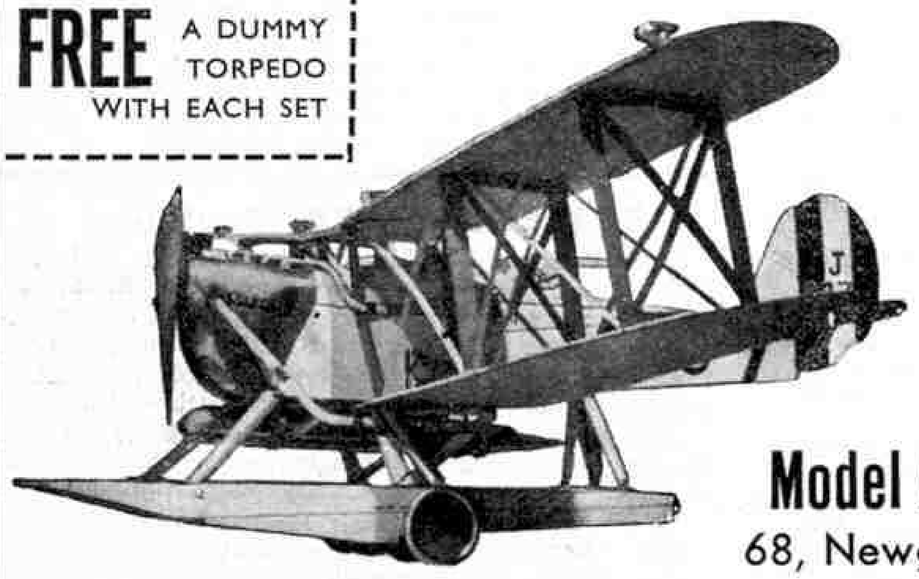


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An illustrated price list of these splendid tables may be had free on application to E. J. Riley Ltd., Deal Works, Accrington.

Hobbies Handbook for 1934

The familiar Hobbies catalogue appears in its 1934 edition under the title of "Hobbies Handbook," which indicates the wide range of interesting matter it contains in addition to the purely catalogue section. As usual, fretwork occupies the main portion of the book, and special articles give practical advice on how to start this fascinating hobby, together with detailed instructions for the making of many popular items, both ornamental and useful. There are illustrated descriptions of every type of fretwork apparatus that could be desired, and the designs are even more comprehensive than in previous editions.

Other special articles deal with the making of gramophones and wireless sets, games, jig-saw and other puzzles, and a wide range of home-made furniture. The lathe worker and the general woodworker are well catered for, and the tools listed and illustrated cover every requirement. Among the other attractive items dealt with are clockwork and steam launches, model sailing boats and aeroplanes, and the ever-popular table tennis.

The Hobbies Handbook, with a free design, can be obtained price 6d. from any bookseller or Hobbies dealer, or from ironmongers.

How to Get More Fun—(*Cont. from page 793*)

"Ports-to-Ports" express connecting Newcastle and Barry. This is a joint G.W.R. and L.N.E.R. service, the stock of each company being used alternately, and the exchange point is Banbury. One of our illustrations shows a miniature "Ports-to-Ports" train entering a station; a G.W.R. locomotive is hauling Hornby Metropolitan Coaches, which are being used here as L.N.E.R. stock.

Coming to G.W.R. goods vehicles, here again the individuality of the company shows itself in many ways. Apart from the special construction of many G.W.R. wagons and vans, the code names applied to them are very striking, but we must confine our attention to certain of the wagons in the Hornby Series that are concerned. Taking the larger wagons first, the Trolley Wagon would be classed as a "Crocodile," and the No. 2 Lumber Wagon as a "Macaw." The No. 2 Luggage Van would be a "Monster" if used for a variety of general traffic, theatrical scenery and similar items. The code name for Cattle Trucks is "Mex," and for Milk Vans "Siphons."

A very characteristic G.W.R. vehicle is the open wagon with tarpaulin bar, known as Open A or Open B, according to whether it has hand brakes only, or is fitted with the vacuum brake for working in fast trains. The Hornby Series has an interesting representative of this type, and its title "Open Wagon B" sounds quite Great Western. A small point that may also be mentioned is that the Hornby Gunpowder Van, lettered in G.W.R. style, carries only the initials "G.P.V.," as in actual practice, instead of the full title of the van used on those of the other three groups.

The No. O Milk Van is of course a G.W.R. vehicle, its design being based on the open-boarded "Siphons" belonging to that company. Good use is also made on that system of milk tank wagons, so that the attractive "United Dairies" Milk Tank Wagon of the Hornby Series should appear on every G.W.R. layout.

The Gas Cylinder Wagon also occurs to mind as a familiar G.W.R. vehicle. Its purpose is to convey the compressed oil gas used for cooking in kitchen cars, and also for refuelling passenger coaches that still employ gas for lighting. They run between depots where the gas is manufactured and those stations where the gassing of coaches is carried out. As the white-painted Great Western refrigerator van is known as "Mica B," this code name may be written on its Hornby counterpart by enthusiasts who are keen on details. The name should appear in the left-hand top corner of the sides of the van, and should be carried out in letters no bigger than $\frac{1}{8}$ in. in height.

An interesting practice that is followed in G.W.R. yards is the attachment to shunting engines of special shunter's flat wagons. They are provided with handrails round them, and a large tool box carries various items likely to be useful in emergencies, such as chains. A suitable Hornby wagon for representing a shunter's truck is the No. 1 Lumber Wagon. Quite realistic railings may be erected on it by connecting the stanchions with cord or wire.

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Model Railway. £8. Quick disposal. 70/-, or separately. Details on request. "M.M.'s," 1931 to date, 7/-.—Pratt, Bodicote, Banbury.

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EDITORIAL AND ADVERTISING OFFICE:—

LIVERPOOL 13, ENGLAND.

Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/- for six issues and 8/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/2 per copy (postage extra), and the subscription rates 8/- for six months and 16/- for 12 months (post free); Canada, where the price is 10c. per copy, and the subscription rates 65c. for six months, and $1.25 for 12 months (post paid).

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SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Daryanamal and Bros., Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

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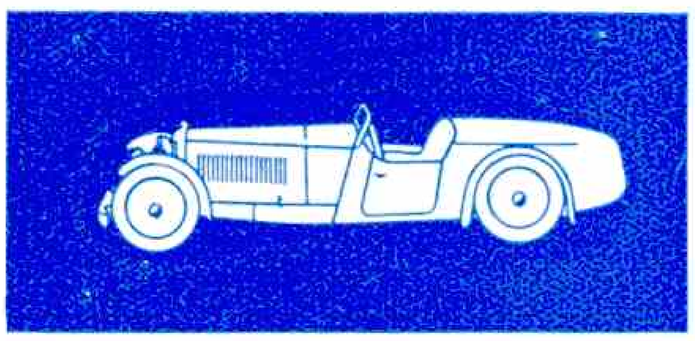
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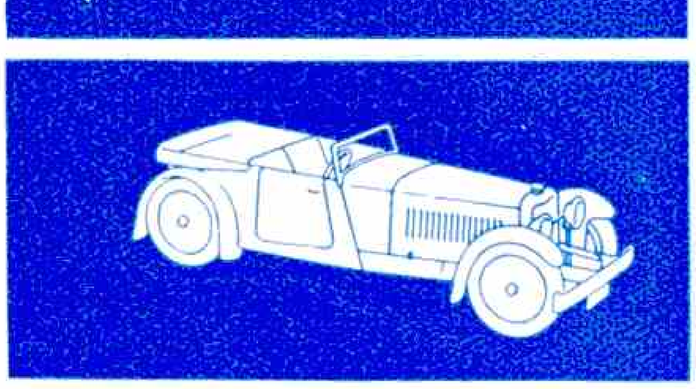
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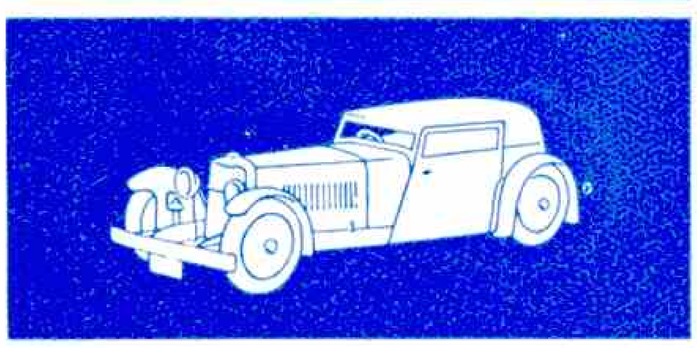
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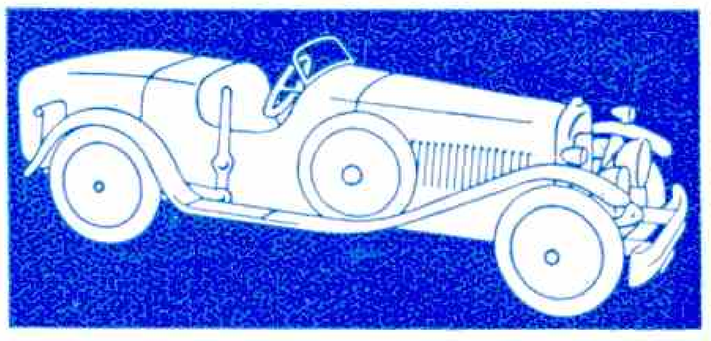


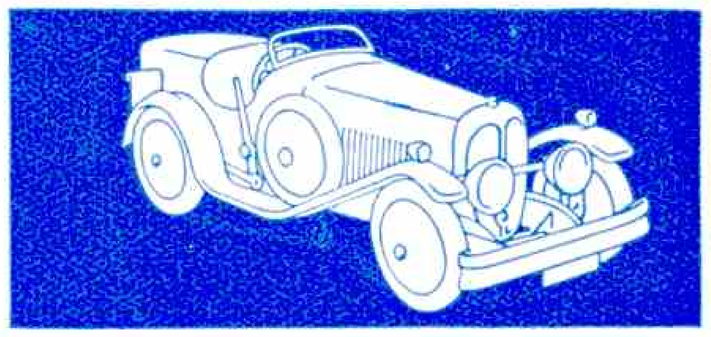
No. 2 Motor Car Constructor Outfit

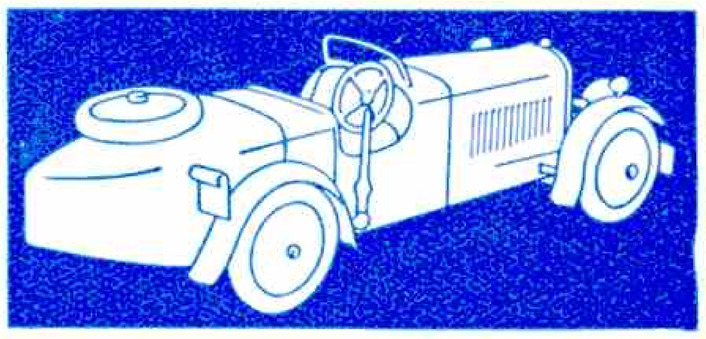








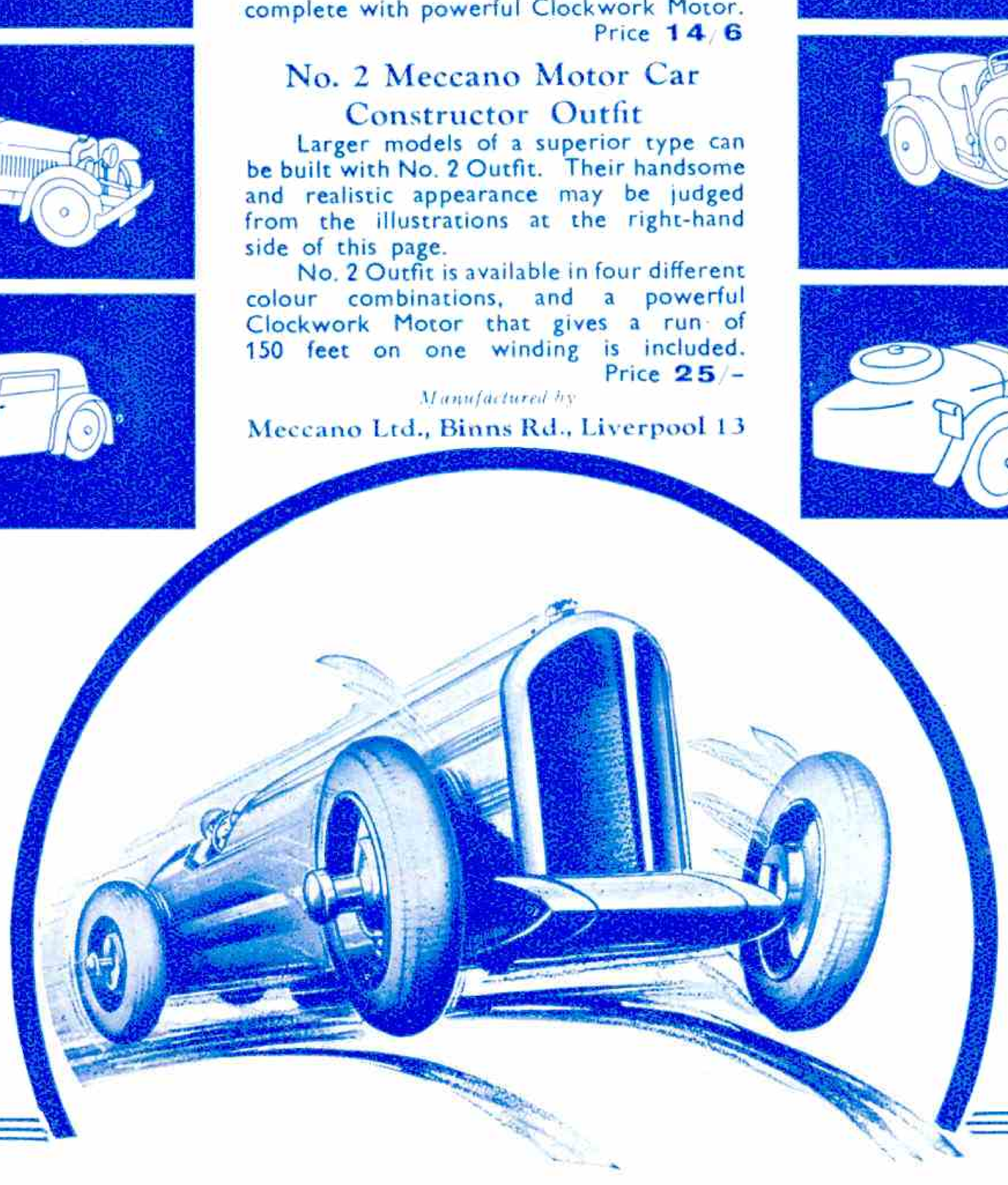




Motor Car Lighting Set

This Lighting Set enables the headlamps of Motor Car models built with the 1933 No. 2 Motor Car Outfit to be electrically lighted. Price **2/6**

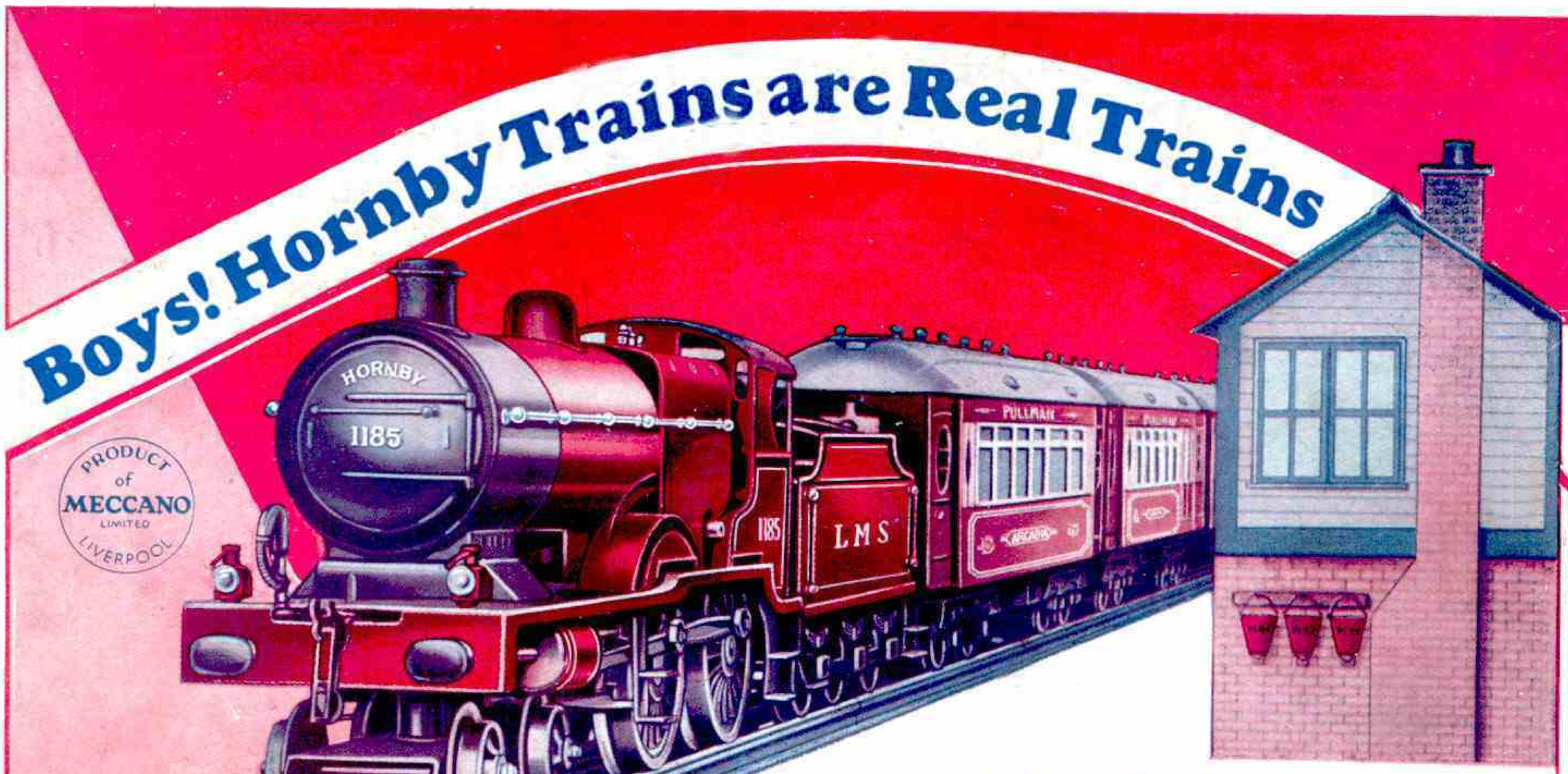
It should be noted that the Lighting Set cannot be used with 1932 type Motor Car Outfit models unless the latest headlamps (price 4d. each) and Instrument Board (price 6d.) are added.



Motor Car Garage

The Meccano Motor Car Garage provides accommodation for any Meccano model motor car or other car of suitable size. It is strongly built, with imitation rough-cast finish. Inside dimensions: Height 5 in., Length 13 in., Width 7¾ in. Price **7/-**

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The illustration above shows Hornby No. 2 Special Train Set, hauled by a Hornby No. 2 Special Locomotive. This Locomotive is a true-to-type model of the real L.M.S.R. Standard Compound Locomotive shown in the illustration below.

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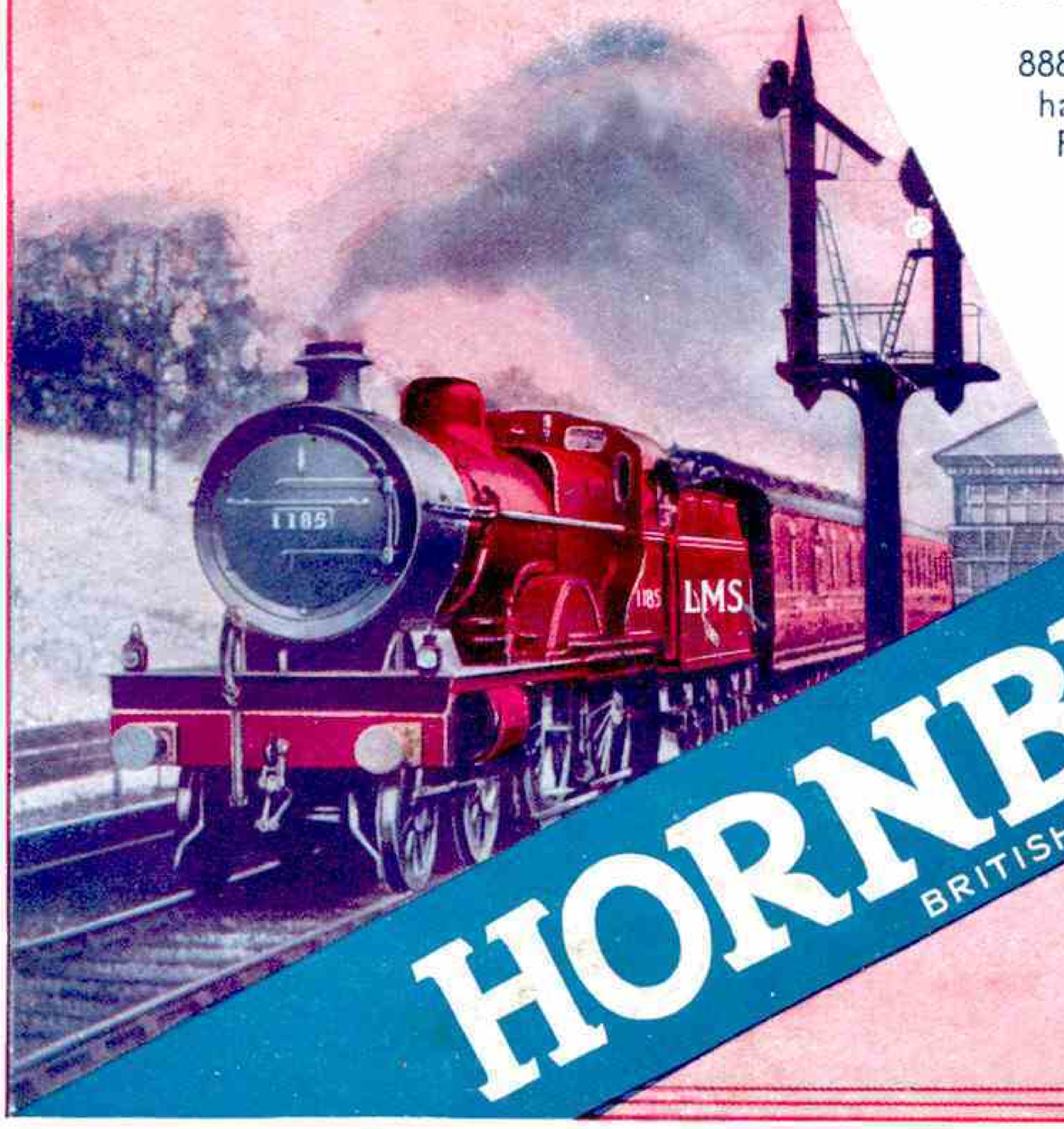
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